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ElectronicsWeek

THE MAGAZINE OF THE WORLDWIDE ELECTRONICS INDUSTRY

CHIP MAKERS FACE MID-LIFE CRISIS

A FRANTIC SEARCH FOR THE NEXT BIG MARKET

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Industry reacts with shock to AT&T's bypass of local phone company/35

Why computer graphics companies are hurting as business soars/59

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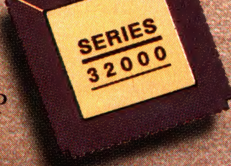

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International edition

PREVIEWS

Next ElectronicsWeek

The latest standings of the 32-bit league

When semiconductor and computer-systems manufacturers talk about 32-bit microprocessors, they give the impression that they are involved in a life-and-death conflict—symbolically, of course—for domination of the marketplace. They see themselves as participating in a market war that could determine, for the rest of this century at least, the commercial pecking order in the electronics industry. What is on the market and who's ahead? For the latest scorecard, see the June 3 issue of *ElectronicsWeek.*

A new niche for EEPROM technology

Electrically erasable programmable read-only-memory technology may have hit pay dirt in the logic arena. Designers at a startup company in Portland, Ore., have paired EEPROM technology with a high-speed CMOS process to build programmable logic parts. The programmable chip relies on EEPROM cells for an electrically alterable architecture so it can directly replace any of 21 device architectures in the 20-pin bipolar PAL family from Monolithic Memories Inc. It's in the next *ElectronicsWeek.*

Looking ahead in ElectronicsWeek

The last word on voice-synthesis systems

Uses for voice output such as weather reports and the time by telephone are not new. However, until recently these services usually have been recorded on tape. But now synthesized speech is inching to center stage. It can be heard in elevators, trains, and cars, giving warnings and messages formerly announced by humans or provided on displays. For the latest in speech-development systems—this one for use with a personal computer—see the June 10 issue of *ElectronicsWeek.*

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THE VOICE OF THE INDUSTRY, HEARD EVERY MONDAY

COMPUTERS IN THE HOME

How can people be induced to adopt them?/40

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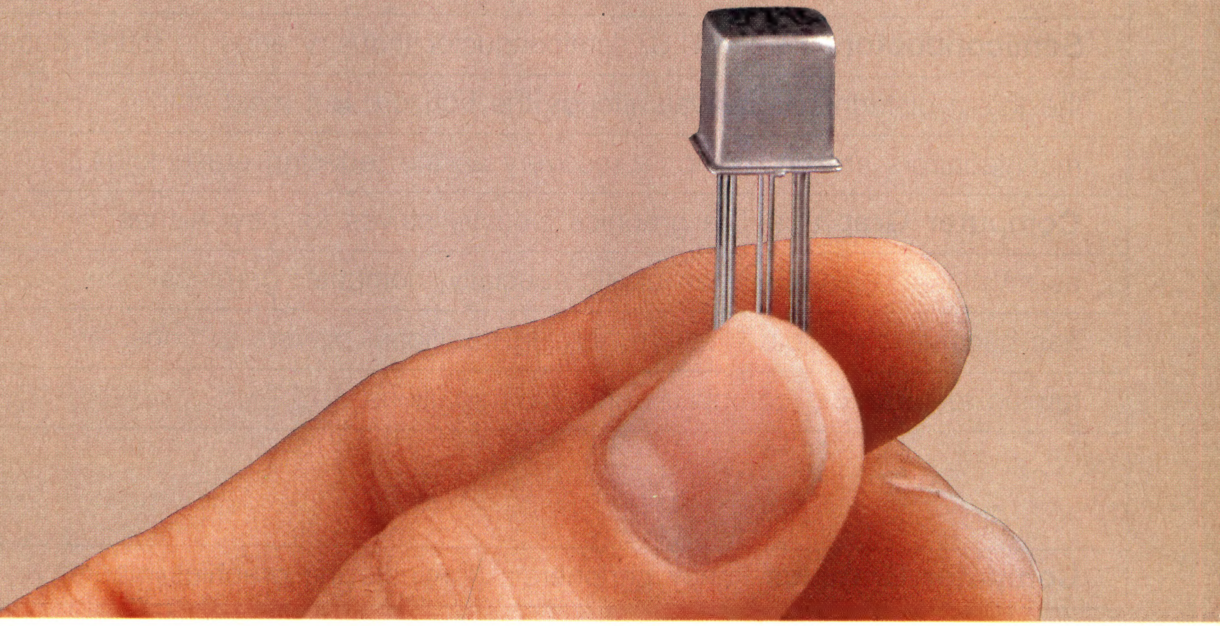

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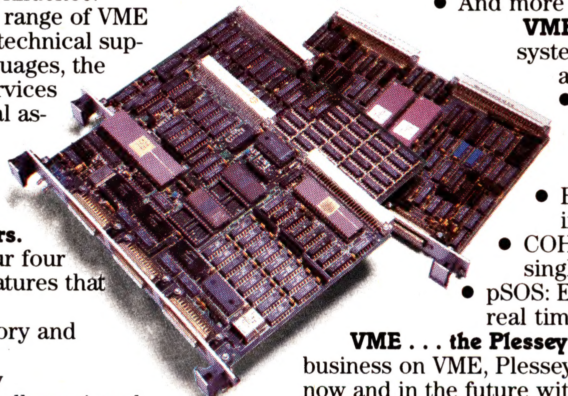

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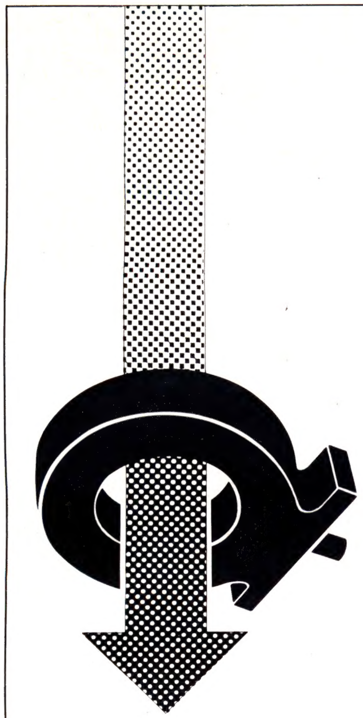

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MEETINGS

VLSI Multilevel Interconnection Conference, IEEE (Microelectronics Research Laboratory, P.O. Drawer EE, Mississippi State University, Mississippi State, Miss. 39762), Santa Clara Marriott Hotel, Santa Clara, Calif., June 24-26.

Videotex '85 International Conference and Exhibition, Online Conferences Inc. (989 Avenue of the Americas, New York, N.Y. 10018), New York Hilton, New York, June 24-26.

Network Management/Technical Control Conference and Exposition, Arus Inc. *et al.* (NM/TC Conference and Exposition, P.O. Box 880, Framingham, Mass. 01701), Convention Center, San Jose, Calif., June 24-27.

Power Electronics Specialists Conference, IEEE and European Space Agency (William W. Burns III, Data General Corp., 4400 Computer Dr., Westboro, Mass. 01580), University Paul Sabatier, Toulouse, France, June 24-28.

Computer Graphics '85 West, National Computer Graphics Association (8401 Arlington Blvd., Fairfax, Va. 22031), Los Angeles, June 25-27.

Computer Storage Industry Conference, Dataquest Inc. (1290 Ridder Park Dr., San Jose, Calif. 95131), The Registry, Phoenix, Ariz., June 25-27.

VCC/East—8th Visual Communications Congress, Graphic Media Inc. (VCC Conference Headquarters, 2378 S. Broadway, Denver, Colo. 80210), New York Coliseum, New York, June 25-27.

Centrex vs. PBX: New Directions, The Eastern Management Group (4 Century Dr., Parsippany, N.J. 07054), Plaza Hotel, New York, June 26-27.

International Conference on CAD/CAM/CAE for Industrial Progress, Computer Society of India and International Federation for Information Processing (Prof. D.K. Subramanian, School of Automation, Indian Institute of Science, Bangalore-560 012, India), School of Automation, Bangalore, India, June 29-30.

Second International Conference on Soil Dynamics and Earthquake Engineering, Computational Mechanics Centre (Elaine Taylor, Ashurst Lodge, Ashurst, Southampton, SO4 2AA, England), *Queen Elizabeth II*, New York to Southampton, June 27-July 3.

International Conference: Post-Failure Analysis of Fiber-Reinforced Composites, Air Force Wright Aeronautical Laboratories (Faye Geidner, Conference Coordinator, 1616 Mardon Dr., Dayton, Ohio 45432), Stouffer's Hotel, Dayton, Ohio, July 1-3.

Laser '85—Opto-Electronic International Congress, Munich Trade Fair Corp. (Postfach 12 10 09, D-8000, Munich 12, West Germany), Munich Trade Fair Central, Munich, July 1-5.

Opportunities for Investing in Telecommunications, IGI Consulting Inc. (214 Harvard Ave., Suite 200, Boston, Mass. 02134), Princess Hotel, Hamilton, Bermuda, July 7-10.

Seminars

Frontiers of Silicon, American Vacuum Society (J.L. Vossen, RCA Laboratories, Princeton, N.J. 08540), AT&T Bell Laboratories, Arnold Auditorium, Murray Hill, N.J., June 19.

X.25 and Packet Switching Networks, Systems Technology Forum (9000 Fern Park Dr., Burke, Va., 22015), Barbizon Plaza, New York, June 19-21.

Evaluation of Occupational Gas and Dust Hazards, Sira Ltd. (Conference Unit, Sira Ltd., South Hill, Chislehurst, Kent BR7 5EH, England), Meeting Rooms of the Zoological Society of London, Regent's Park, London, June 20-21.

Silicon Processing for the VLSI Era, University of California and University of Hawaii (University of California, Irvine Extension, P.O. Box AZ, Irvine, Calif. 92716), Hilton Hawaiian Village, Honolulu, June 24-28.

Orientation into Machine Vision, Automated Vision Association (P.O. Box 1366, Dearborn, Mich. 48121), Cleveland Airport Marriott Hotel, Cleveland, June 26-27.

PBX & CBX: Evaluating and Selecting the Options, Center for Advanced Professional Education (CAPE, 1820 E. Garry St., Suite 110, Santa Ana, Calif. 92705), Stapleton Plaza Hotel, Denver, June 26-28.

The Integrated Voice/Data PBX: Architectures and Products, Technology Transfer Institute (741 Tenth St., Santa Monica, Calif. 90402), Infomart/Wyndham Hotel, Dallas, June 26-28.

CAD 2001: The Countdown, CAD Seminars Inc. (150 E. Riverside St., Suite 4000, Austin, Texas 78704), Boston, June 26-28.

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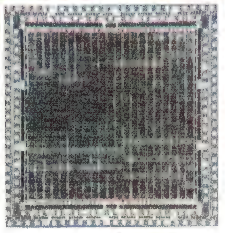

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Circle 12 on reader service card

UP FRONT

Spate of Unix boxes that run MS-DOS software due this year

Some five Unix-based hardware products sporting a built-in or optional MS-DOS emulation environment will likely be introduced by year end, probably at Comdex/Fall. That word comes from Phoenix Software Associates Ltd., a Norwood, Mass., microsystems software specialist. Computers or work stations based on 68000s or other processors can run MS-DOS as a task under AT&T Bell Laboratories' Unix operating system through the addition of an Intel Corp. processor—such as an 8086 or a 80286. Manufacturers of Unix hardware can thus enable their customers to run thousands of programs written for the IBM Corp. Personal Computer and compatibles, in addition to (and at the same time as) software written for Unix. ☐

Despite slight April gain, component book-to-bill is still off

For the first time since last December, component distributors' book-to-bill ratio has moved slightly higher. It was 0.97:1 in April, up from 0.93:1 in March. However, the National Electronic Distributors Association (NEDA) is quick to add that the marginal increase stems from a deeper April decrease in shipments than in bookings. Overall, NEDA reports, the April daily-average shipment rate declined 8% from March, and stood 20% lower than in April 1984. Year-to-date shipments are running 13% behind last year's. Bookings, which are off 4% from March, are running 33% behind the rate at the same time last year. ☐

ROM to ease software task for briefcase computers

After July it should become easier to build software and character fonts into briefcase computers. That's when NEC Corp. will start selling its 2-Mb CMOS mask read-only memory, the μPD23C2000. It uses 1.2-μm silicon-gate CMOS technology to squeeze about 2.4 million elements onto a 6.63-by-8.42-mm chip. Access time is 250 ns maximum, and standby current is 100 μA maximum. The price in lots of 1,000 is expected to be $32.

Also due this summer, and suitable for some types of portable equipment, is the μPD42832 32-K pseudo-static memory chip designed for moderate-interval battery backup. This chip, which actually is a 256-K dynamic random-access memory with CMOS peripheral circuits designed for self-refresh operation, is available with maximum standby current as low as 100 μA. ☐

TI sues voice-technology firm after office search

Claiming highly confidential documents were copied and misappropriated from its speech-research lab by former employees, Texas Instruments Inc. has filed suit charging theft of trade secrets against Voice Control Systems Inc., a small Dallas company. The focus of a Dallas County investigation and a controversial search warrant, the charges allege theft by former TI researchers—including Thomas Schalk, who joined Voice Control Systems in 1983 as chief technical officer. Before leaving TI two years ago, Schalk had been deeply involved in the development of speech-recognition algorithms. Voice Control Systems licenses its phonetic-based technology for speaker-independent recognition applications. In March, the firm introduced a voice-activated system for telecommunications, providing speaker-independent control regardless of the user's age, gender, accent, tone of voice, or elocution. A spokesman for Voice Control Systems tersely denies the allegations, saying a raid on the firm's office by district-attorney investigators was "totally out of character." The investigators are reported to have searched offices for 26 hours, cutting phone lines, preventing employees from leaving, and restricting use of computers, complains the spokesman. ☐

UP FRONT

Government approves Landsat transfer to RCA-Hughes company

Bowing to congressional pressure, the Reagan Administration last week approved the transfer of the Landsat satellite system to Earth Observation Satellite Co. (Eosat), a partnership formed by RCA Corp. and Hughes Aircraft Co. In so doing, the government will ask for an initial $125 million subsidy for Eosat over the objections of the Office of Management and Budget. The cost of building and launching two new satellites that would compete against a similiar French satellite system expected to be launched next fall is estimated to be $250 million. Operated by the government since 1972, Landsat's photographs of the Earth's surface are used to forecast crops and locate mineral deposits. The only operational Landsat satellite remaining is expected to reach the end of its design life by early 1987, and Commerce Department officials had argued that the French system would capture the market. ☐

Zilog moves into memories, broadens product line under Sack

Zilog Inc., the Exxon Enterprises perennial problem child, is gearing up to become a more aggressive merchant company under its new president, Edward A. Sack. Formerly senior vice president of General Instrument Corp.'s microelectronics group, Sack's immediate strategy is to broaden Zilog's product line from a microprocessor-only catalog to a host of peripherals and nonvolatile memories. Shortly after his arrival, he cut prices 15% to 40% across the board on existing products, then dusted off a list of more than 100 never-used second-source rights and put 10 into production, with 10 more to be added in June. Zilog will not make memories, but will market U.S. and Korean products on a private-label basis. Zilog has also obtained first silicon on the Super 8 high-speed version of the Z80, and expects first silicon for its long-delayed 32-bit central processing unit, the Z80000, next month. ☐

Singapore to replace phone book with videotex

The Telecommunications Authority of Singapore plans to give up to 1 million terminals, instead of telephone directories, to almost every home and business in the country by 1990. The move will be part of a pioneering advanced TV-based information system that uses the telephone line and a dedicated 625-line TV channel to provide electronic messaging, two-way Telex, and photo videotex services. Called Teleview, the service has been developed to get around the problems of sending Chinese characters quickly over the telephone line. Subscribers will use TV sets with special adapters to telephone a central computer. Information may come back through the telephone or be broadcast on a dedicated TV channel. A 1,200-terminal pilot system, modeled on British telephone-based Viewdata and broadcast-based Teletext systems, will start public service in March 1987. ☐

Electronics culprit in much unscheduled fighter plane repair

Although electronic gear constitutes only 10% to 15% of the empty operating weight in a typical fighter plane, electronic-systems breakdowns are responsible for 45% to 50% of all of unscheduled maintenance on its fighters, reports the U.S. Air Force in a recent study. The disparity may soon lead to tougher guidelines for suppliers of such systems, Air Force Lt. Gen. Thomas H. McMullen told a gathering at the National Aerospace and Electronics Conference (Naecon) last week in Dayton, Ohio. McMullen, commander of the Air Force Systems Command's Aeronautical Systems Division at nearby Wright-Patterson Air Force Base, said that the Air Force is formulating a more disciplined approach to electronics evaluation for future aircraft systems, one with heavier emphasis on routine scheduled preventive maintenance. ☐

THIS ElectronicsWeek

THURSDAY *May 16*

Flexible Computer Corp. said it will implement Verdix Corp.'s Ada programming-language compiler on its Flex/32 multicomputer. Flexible said it was the first commercial implementation of Ada, which was developed under the direction of the Defense Department to reduce software development and maintenance costs, for a parallel-processing computer. . . . **AT&T named James E. Olson president and chief operating officer,** effective June 1. Olson, 59, is the first to fill the position since the breakup of the telecommunications giant last year. The move brings AT&T Co.'s long-distance telephone division under Olson's command; he has run the company's other divisions since 1984.

FRIDAY *May 17*

The U.S. Commerce Department today reached **a trade agreement to ease the transfer of American high technology to India.** Exports of computers, telecommunications equipment, and other electronics supplies will be expedited under the accord, which does not cover nuclear or military technology, said officials in Washington, who declined to specify details. India had complained of restrictions and delays in obtaining export licenses. . . . The Federal Communications Commission approved licenses for **the installation of PTAT, the first transatlantic fiber-optic submarine cable system.** **Tel-**Optik Ltd. said the first of its two cables should be completed in 1989 and will cost an estimated $300 million. Called PTAT-1, it will consist of three operational pairs, with each pair capable of transmitting at a 280-Mb/s clip.

MONDAY *May 20*

National Semiconductor Corp. and Digital Equipment Corp. announced a joint effort to develop factory-automation software for semiconductor plants. Project Odyssey is aimed at making the Semiconductor Equipment and Materials Institute's SECS (Semiconductor Equipment Communications Standard) protocol an industry standard, the companies say. Unisecs, the first package in the series, communicates the SECS protocol from DEC's PDP-11 minicomputer to the chip-manufacturing equipment. **National and DEC estimate that SECS can slash the turnaround time for custom integrated circuits from 2½ weeks to just 15 hours,** thanks to improvements in process control and time management.

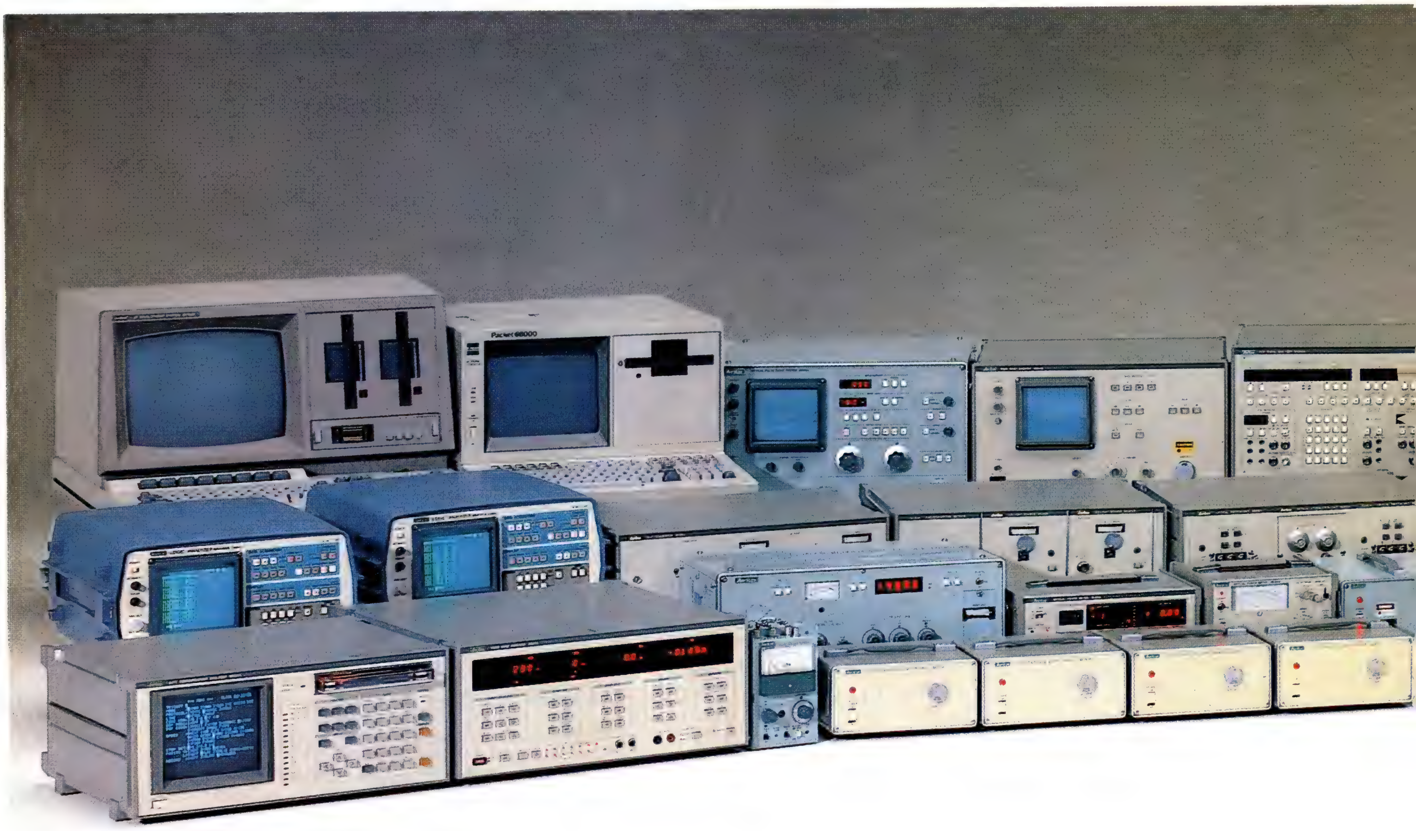
TUESDAY *May 21*

AT&T formed a Medical Information Systems unit that will integrate computers and communications products for large hospitals and related medical professionals. Development and testing of an integrated hardware and software system has already begun at Columbia Presbyterian Medical Center in New York, the company said.

WEDNESDAY *May 22*

Hitachi America Ltd. said it developed **a single-chip CMOS microcomputer with a one-time electrically programmable read-only memory.** The 8-bit chip has a built-in 4-K byte EPROM in addition to 192 bytes of random-access memory and a serial-communications interface that can operate in either synchronous or asynchronous modes. Cutting the high mask costs necessary for more conventional parts, the chip permits users to burn-in proprietary software, which can result in significantly improved turnaround. The 2-MHz part sells for $15.95 in quantities of 1,000. □

Better Instruments for Better Communications



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Circle 17 on reader service card

FCC LOOSENS REINS ON FREQUENCY HOPPING

Secure low-power links are now possible without encryption for sensitive voice communications

Washington

Imagine the chagrin of police officials about to make an arrest or raid on a quiet residential street after months of surveillance, only to find that the malefactors have fled—or even worse—that television news crews are already on hand to record the event.

Such scenarios are becoming almost commonplace, says a Federal Bureau of Investigation spokesman, as eavesdropping on law-enforcement channels reaches epidemic proportions. But the Federal Communications Commission has come to the rescue with a potent new spread-spectrum security shield for local law-enforcement officials. Under the FCC's new ruling, the low-power carrier frequencies would be hopped pseudorandomly—making it difficult to monitor or jam police transmissions by conventional means.

FCC encourages R&D. The new regulations will open up portions of the industrial, scientific, and medical services bands. Through them, the FCC means to encourage research and development in a technology that has heretofore been confined largely to military applications.

"The commission is taking it out of the realm of an experimental technology and encouraging people to build hardware," says Eric Schimmel, vice president of the mobile communications divisions at the Electronic Industries Association.

Secure surveillance. Police officers on sensitive stakeouts can foil would-be eavesdroppers by using frequency hopping on low-power local radio communications.

Law-enforcement officials are not exactly rushing to embrace the new radio technology. Part of the reason may lie with the profession's inherent conservatism. "Any new technology must come only after proponents of that technology have proven beyond a shadow of a doubt that it will not cause interference to existing systems," said the Association of Public Service Communications Officers in its comment to the FCC on spread spectrum.

Questioned by police. There is a question whether this kind of spread-spectrum communication—authorized in early May by the FCC for the 902-to-928-, 2,400-to-2,483.5-, and 5,725-to-5,875-MHz bands for broadcasts powered at less than 1 W—will find widespread use. "We've never used spread spectrum, and at this time I don't envision its use," says Hal Bloomberg, chief communications engineer for the New York Police Department.

Bloomberg points out that NYPD radio communications have never been jammed intentionally and when sensitive voice communications must be protected, digital encryption is the usual method used. This makes eavesdropping difficult because the signal—which is digitized, compressed, and finally encrypted using a block cipher—sounds like noise to anyone listening in. However, critics maintain that because encrypted voice is usually transmitted on a single frequency, it can be recorded and later decoded.

Like their New York counterparts, communications officers of the Los Angeles Police Department also favor encrypting sensitive voice transmissions. "Any law-enforcement agency wants privacy; it's the cost that is the determining factor," says Capt. Keith Bushey of the LAPD Communications Division.

Also dampening police enthusiasm is the great confidence already placed in encrypted voice and concerns about the cost of developing new systems. For example, after a thorough investigation, the FBI decided to buy 15,000 radios with integrated encryption capabilities at a cost of more than $100 million.

"We used it [digitally encrypted voice]

successfully at the Olympics in Los Angeles, and now it's going out to our other large offices," says William A. Bayse, director of the technical services division of the FBI. "I think there is a certain utility in spread spectrum, but given the scale of what we are doing, we chose digital encryption."

Motorola Inc., the largest supplier of radio equipment to police agencies—a substantial portion of it encryption equipped—obviously is backing voice encryption over spread spectrum. "Frequency hopping just doesn't deal with the central issue: the fact that you put voice out on a radio frequency," says Steven Reddick, a market planning manager for secure-communications products. "Only encrypting destroys the syllabic content of the message."

No tipoff. Others hear a different message. "If a group being monitored by the police listens to the law-enforcement frequencies—even when encrypted—and hears too much action, that's a tipoff," explains John Kuijvenhoven, president of Transcrypt International, a Lincoln, Neb., firm that has been shipping frequency-hopping gear to the U.S. and foreign governments for six years.

Since most of Kuijvenhoven's customers are not subject to FCC regulations, he has been offering rated power output ranging from 2 to 100 W in two models that hop in 10-kHz steps. One is a 500-channel version with a spread of 5 MHz; the other has 1,000 channels spread over 10 MHz.

With up to 1 million pseudorandom codes and a dwell time on any channel of only 78 to 89 ms, the equipment is very secure, Kuijvenhoven claims. A new low-power version that will conform to FCC regulations is being readied for local law enforcement.

Rettig Electronics Inc., Rockville, Md., is also supplying frequency-hopping equipment to state agencies here and abroad. Alfonso Rettig, the firm's president, says that the base stations and mobile gear can be programmed to hop among 88 channels using 10 different pseudorandom programs. Dwell times can be selected for 10, 40, and 80 hops per second.

Making available low-power frequency-hopping equipment for law enforcement is only the first of several moves planned by the FCC to open up spread spectrum to more applications [*Electronics,* May 17, 1984, p. 50]. In a separate ruling, the FCC said that next year spread-spectrum communications will be available to amateur radio enthusiasts in the bands above 420 MHz.

It also went on record as saying it will act on a request by Hewlett-Packard Co. to use direct-sequence spread spectrum for wideband local-area networking. *–Robert Rosenberg*

INTEGRATED CIRCUITS

NEW HIGH-SPEED CMOS CHIPS VIE WITH FAST TTL

With 1- and 2-μm fabrication processes in hand, chip makers are readying a new generation of high-speed CMOS logic that can match the performance of some of today's fastest bipolar-Schottky components. Thus they expect to snatch business away from competing TTL parts, which long have dominated glue-logic markets.

Ironically, two likely pacesetters in advanced CMOS are also two leading U.S. suppliers of advanced bipolar TTL: Fairchild Camera & Instrument Corp., which produces the Fast TTL line, and Texas Instruments Inc., which has teamed up its advanced Schottky and advanced low-power Schottky (AS/ALS) logic families. The battle brewing for an early foothold in advanced high-speed-CMOS logic pits many ex-TI executives now leading Fairchild against their former employer.

TTL STILL DOMINATES GLUE-LOGIC MARKET

	($ millions)		
	1983	1985	1989
High-speed CMOS (silicon-gate)	76	231	472
High-speed CMOS (with TTL levels)	18	92	183
Metal-gate CMOS	387	449	684
Bipolar (TTL and ECL)	1,900	2,300	2,400
Other	–	18	31
Total standard logic	2,381	3,090	3,770

SOURCE: DATAQUEST INC.

While TI and Fairchild separately prepare advanced high-speed-CMOS products for introductions in the second half of 1985, a host of first-generation high-speed-CMOS logic merchants—Motorola, National Semiconductor, RCA, and Signetics, plus a number of smaller CMOS startups—are honing their own follow-on families.

RCA Corp. also expects to bring out its first advanced high-speed-CMOS products later this year; Motorola, National, and Signetics will probably preview their parts next year. In Japan, Toshiba Ltd. has an advanced-high-speed-CMOS line in the wings and could make samples available during its next fiscal year, starting April 1, 1986.

At stake is new high-performance segment of a growing CMOS discrete-logic business, projected to more than double in four years from sales of $323 million in 1985, says Dataquest Inc. (see chart). With propagation gate delays about a third those of conventional CMOS and drive currents three to four times greater, the advanced high-speed-CMOS logic generation is expected to take CMOS technology into speed-critical portions of equipment designs formerly served only by bipolar components. Higher fanout drive of many advanced high-speed-CMOS parts will allow CMOS logic signals to interface directly onto fast microprocessor buses.

Using a new 1-μm silicon-gate process, TI later this year plans to launch the first batch of parts in its full advanced high-speed-CMOS logic line. TI's family, which will be designed to perform at AS and Fast levels, will contain new large-scale integrated functions as well as many of the most popular glue-logic parts found in low-power Schottky and high-speed-CMOS portfolios. The new 1-μm technology is akin to TI's 1-μm CMOS process, now being used for early samples of a 1-Mb dynamic random-access-memory chip.

"It will be a glue family, but there will not be a need for as many functions as we have in standard logic lines today. It will no longer be a race of how many functions you can put out," notes Naresh Batra, marketing manager of TI's CMOS Division in Dallas. During the past two years, TI has introduced some 150 HC logic and 35 HCT (high-speed CMOS interface devices with TTL logic levels) components. The 1-μm advanced high-speed CMOS products, which will also include AHCT TTL interface parts, will probably show improvements in typical gate delays of 2 to 3 ns compared with 7 ns on standard high-speed-CMOS parts.

Hard driving. Late this summer, Fairchild promises to debut its advanced high-speed-CMOS line, dubbed simply Advanced CMOS. The new logic family is made from a new 2-μm double-metal, single-polysilicon, p-well process. The process, which uses only nine masking steps, is the same technology used on a new reduced-instruction-set-architecture 32-bit microprocessor from Fairchild. It will produce logic components with typical gate delays of 5 ns and can sink and source 24 mA of current, says Ray Becker, product planning manager for

BIPOLAR, STANDARD CMOS LOGIC REMAIN STRONG

Despite the increasing speeds and drive currents promised by the next generation of CMOS logic, the equipment markets will probably support strong growth in both fast bipolar and CMOS technologies well into the next decade. At least that's the view at both Texas Instruments Inc. and Fairchild Camera & Instrument Corp.

Fairchild is trying to reposition its bipolar Fast line with a series of new large-scale integrated circuits, aiming at yet higher thoughput. "We think bipolar has life in it yet, and CMOS is definitely a region, of sorts," quips Ray Becker, product planning manager for the Mountain View, Calif. company's digital logic division. "I see [bipolar logic] going on for at least another 10 years, if it is positioned properly."

Becker says bipolar and CMOS technologies promise chip densities of up to 50,000 gates and speeds approaching 1 GHz. "You won't do the two together, but with bipolar you can get the gigahertz level, and CMOS will get 30 to 40 MHz," he adds. "CMOS promises the high density with lower power."

TI's bipolar logic operation is pressing for higher speeds with walled emitters and its oxide-isolation Impact process. Naresh Batra, marketing manager for TI's CMOS division, notes that advanced high-speed-CMOS consumes about as much power as bipolar technologies when running at high speeds. "But the benefit is related to the duty cycle of the system. If a node is toggled only 10% to 20% of the time, that means CMOS will be using a fourth or a fifth of the power of an equivalent bipolar node," he says, noting the low-power standby state of CMOS. "Bipolar is static, and it continues consuming power whether [or not] the node is clocked." –J.R.L.

Fairchild's Digital Division.

"We are taking a fairly conservative approach to simple gate functions. What we have done, however, is position our family so that the initial products are more oriented towards bus interface functions and some of the more popular devices like shift registers," he says. "But we recognize in the longer term—12 to 18 months—there will be a need for filling out the family with some of the standard functions we have seen before." Part of the reason for waiting is that Fairchild believes much of the simple LS glue-logic business will be consumed by growing semicustom gate arrays and standard cells. Becker says studies indicate "60% of the LS in certain functions will disappear by 1988."

With improved speeds and drive currents, Fairchild believes silicon-gate CMOS logic will at last live up to what it believes has been unmet expectations in the high-speed-CMOS arena. Becker cites Dataquest figures estimating that some 26 high-speed-CMOS logic vendors were chasing only $200 million in sales last year. Higher costs—resulting from high-speed-CMOS dies twice the size of LS chips with equivalent speeds—have stymied growth potentials, Becker adds.

Schottky shot? One casualty this month to a lower-than-expected demand was Zytrex Corp. of Santa Clara, Calif., which closed its doors after mounting losses forced it to file for Chapter 11 bankruptcy. Zytrek, which used a 2-μm CMOS process to yield 1- to 5-ns gate delays, promoted itself with billboards and ads saying "Who shot Schottky?" and "Bipolar bites the dust." Most market participants agree Zytrex's demise casts little doubt on advanced high-speed-CMOS markets, but illustrates the importance of selecting the right logic functions and timing of introductions.

Also in Santa Clara, five-year-old Integrated Device Technology Inc. is using its 1.5-μm complementary enhanced MOS, dubbed CEMOS, to produce two new lines of high-speed logic devices with speeds of Fairchild's Fast and ALS components. Introduced at the beginning of the year, some of the firm's FTC parts exceed Fast's fanout drive, offering as much as 48 mA. Most of the advanced logic efforts are focused on octal circuits, decoders, and memory interface components.

With so many competitors planning next-generation products, the evolution of advanced high-speed CMOS will be considerably different from the start of the high-speed-CMOS era, which was kicked off with a 1981 joint-development pact between National Semiconductor Corp. and Motorola Inc. "There are a great many things playing into the market. One is there are a great number of competitiors in the high-speed-CMOS field," says Roger Reak, director of CMOS logic and LSI at National. "That has changed everyone's approach to the follow-on logic families." One impact is that a proliferation of slightly faster logic families have hit the market with many companies boosting performance, shrinking existing designs, and winnowing out the faster parts during testing.

"It is not our intention to announce another family with those mechanisms," states Reak. Some parts in National's current high-speed-CMOS logic line are fabricated using 2-μm design rules, with speeds reaching close to ALS speeds. "There are some process developments under way using mixed processes on the same die [CMOS and bipolar] which may in fact result in devices with significantly better drive capability," he says, adding that no introductions are expected this year. *–J. Robert Lineback*

TEST AND MEASUREMENT

NETWORK TESTER ACCENTS THE NEGATIVE

Ashland, Mass.

When a data-communications network crashes, relief for harried network managers is is often spelled TDR, as in time-domain reflectometer. TDRs send pulses down coaxial cables and analyze the signal signature of the return echo to pinpoint faulty sections, even in cables that may wind thousands of feet through ceilings, walls, and floors.

Trouble is, most TDRs work with positive pulses that could conceivably blow transceivers along the network (a large percentage of which are Ethernet). At about $300 per transceiver, network managers prefer not to take that chance. But shutting down the system can itself be costly in large networks with perhaps scores of nodes and difficult access.

Faced from time to time with that quandary, the Cabletron Division of Collingsworth Corp., a cabling company based in Ashland, Mass., developed for its own use a negative-pulse TDR that would allow testing without a system-wide shutdown. Conventional TDRs were effective when installing systems, says Chris Oliver, director of manufacturing and engineering for Cabletron, but positive pulses posed problems for troubleshooting.

Prototype into product. The negative-pulse prototype has since been refined, and Cabletron is selling it as the TDR 5000. The unit has a free-running 30-kHz oscillator and a generator that provides a –3-V pulse into a 50-Ω load over 20 ns with a rise and fall of 5 ns. The TDR is ac-coupled to the cable under test and has switched-source imped-

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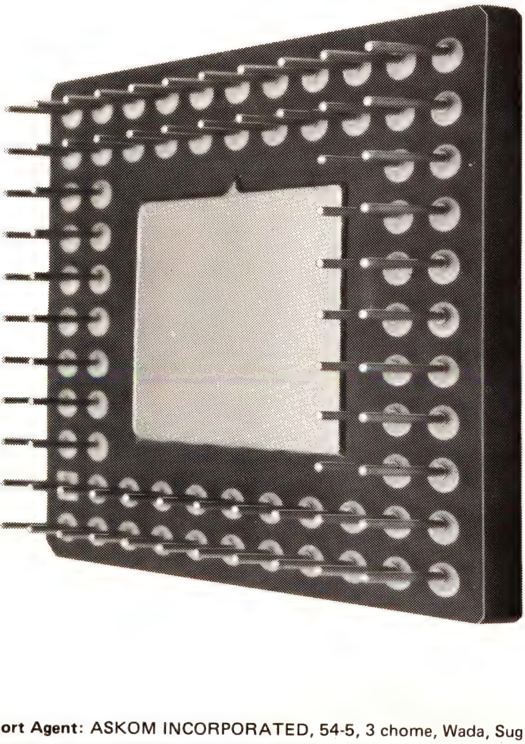
Circle 21 on reader service card

A FASTBUS NEEDS A FAST DRIVER: FMA601.



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Circle 75 on reader service card

Survival in the electronic 80's requires better decisions, not just better designs.

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ElectronicsWeek

THE MAGAZINE OF THE WORLDWIDE ELECTRONICS INDUSTRY

INDUSTRY'S VERDICT:

A GOOD YEAR AHEAD

In a window. Cabletron's director of operations, Craig Benson, sees only a short-term market opportunity for his company's negative-pulse time-domain reflectometer.

ance selectable from 50 to 75 Ω. An attenuator makes it possible to adjust the system sensitivity. In the most sensitive mode, a 2-mV return signal will produce a 1-cm, or one division, deflection on the TDR screen.

Oliver explains that there is no need to shut down all nodes along the system when using this negative pulse because the terminators are removed from each end of the system. "So the signal reflects back at twice the amplitude, causing the stations to see that as a collision and it goes into back-off algorithm," he says. End-users unaware the system is down for test would receive error messages in 15 to 30 s, depending on the system protocols. Typical test time is 3 to 5 min.

Not for broadband. Craig Benson, Cabletron's director of operations, concedes that these machines offer no advantage in testing broadbroad systems. But for use on Ethernets, he believes the advantage of not having to shut down will make them competitive. Currently, only Tektronix Inc. and Biddle Instruments, based in Blue Bell, Pa., market TDRs in the U.S., and theirs are positive-pulse machines.

Judy Estrin, executive vice president of Bridge Communications Inc., a networking company in Mountain View, Calif., says that not having to close a system down is becoming increasingly important. "More and more networks are used in large configurations, [sometimes] thousands of users with hundreds of nodes," she says.

With less sophisticated end-users, she adds, more tools are needed to manage networks. "The vendors are putting a lot more effort into network management. If you looked at LAN products three or four years ago versus today, you'll find more network management."

For its part, Cabletron hopes to exploit what it believes to be a short-term market opportunity. The company is preparing a patent application and plans to begin shipping the TDR 5000 in June at a price of $4,500. According to Benson, approximately 8,000 to 9,000 TDR machines were sold in the U.S., with Tektronix grabbing more than half the market. Most of those machines are sold to field-service personnel and end-users with networks that are either large enough or of great enough importance to justify the cost. But Benson believes the market will only grow for about three years before it is saturated and eclipsed by other technologies.

International Resource Development Inc. estimates that the market for networks will grow from $405 million in 1985 to $1 billion in 1988. There will be increased spending for baseband coaxial networks, IRD figures, although their market share will shrink from 40% in 1985 to 30% by 1987.

Naomi Kalmus, a senior consultant at IRD, says Ethernets won't grow as fast as the overall market because many end users are waiting for a network from IBM Corp. Benson adds that the growth of fiber-optic networks will also cool the baseband market. *–Craig D. Rose*

NAVIGATION

SATELLITE NAVIGATION STILL FAR OFF FOR CARS

Boulder, Colo.

Satellite navigation systems for automobiles are going to be extremely accurate. However, that won't do ordinary drivers any good in the immediate future.

The view from the Institute of Electrical and Electronics Engineers Vehicular Technology Conference held in Boulder, Colo., last week was that the Department of Defense still won't make the most accurate signals from its growing network of global positioning satellites available to civilians. Indeed, even the military version of the Global Positioning System will not permit motorists to simply scroll an on-board electronic map and know what street they're on.

This view flies in the face of some of the glowing predictions from makers of optical disks, who seek to sell their product as a storage medium for digitized maps in GPS navigation. But according to Air Force Col. Phil J. Baker, "The

Finding the way. Equipment such as this GPS time and frequency monitor is available for yachts. However, the price will have to come down before motorists can be expected to use it.

highest GPS accuracy we could provide without jeopardizing national security is 100 meters of true geodetic position." (Some 95% of the positioning information falls within 2 standard deviations, which is the civilian standard.) The Pentagon believes that by providing civilians with Mil-Spec GPS receivers (accurate to within 10 m of true geodetic position), some would inevitably fall into the hands of a potential enemy, thereby vitiating an important advantage for U.S. and allied troops.

Two navigation services are involved in GPS: the Standard Positioning Service, whose main civilian market will be aviation, where 100-m accuracy is perfectly adequate for aircraft except when approaching the runway; and the Precision Positioning System for the military. In implementing SPS, the DOD plans to encrypt the PPS signal and intentionally degrade its accuracy for unclassified users—that is, car and truck drivers. Thus, a driver using a GPS receiver might derive some advantage from it on an open road, but it would be worthless in a city.

Peter H. Dana, an independent navigation consultant in Austin, Texas, believes that with the present Pentagon scheme the only practical approach to GPS-based automotive navigation would have to involve differential processing of the GPS signal. Stationary GPS receivers whose precise positions are known would be set up in an urban area to monitor range information from a minimum of three GPS satellites. A range correction would then be sent over a radio link to a GPS receiver, thereby overcoming the degradation of a single satellite's vehicle signal.

System is the solution. Thomas A. Stansell Jr. of the Magnavox Advanced Products and Systems Co. in Torrance, Calif., also believes that for cars to navigate with GPS, "a systems solution is required. A digital map will be necessary to interpret the coordinates, and a digital radio link [from the stationary receivers] will provide differential range corrections for greater accuracy," he says. "The radio is in the automobile now, computers are moving into it, and displays are becoming more competent. Adding and integrating GPS will be a natural step by the year 2000."

Between now and then, however, a few things have to happen if GPS is to enter the lives of automotive consumers. The DOD must lift its restriction on civilian use of PPS, and user fees for the system must be eliminated. Above all, GPS receivers must come down in cost.

Though there is progress to report on all three fronts, automakers are not likely to benefit from it for many years. Stansell expects that "the need for accuracy denial will eventually disappear" but probably not before the end of the century, he says. Dana expects GPS receivers to drop in price from their current $15,000 to about $2,000 by about 1988—but that is still too expensive for the automotive market.

User fees, however, have recently been waived for "national-intent" uses, further encouraging the development of low-cost GPS receivers. Says Stansell, "The [eventual] availability of low-cost equipment will fuel an explosion of applications, assuring that civil users worldwide will vastly outnumber military users."

For now, though, the automotive market for GPS will probably be limited to owners of large truck fleets who can use it to keep tabs on their rigs' whereabouts; for them, the incremental cost of a few thousand dollars per receiver is not prohibitive. *–David M. Weber*

EXPERT SYSTEMS

SOFTWARE TRANSFORMS EXAMPLES INTO RULES

Austin, Texas

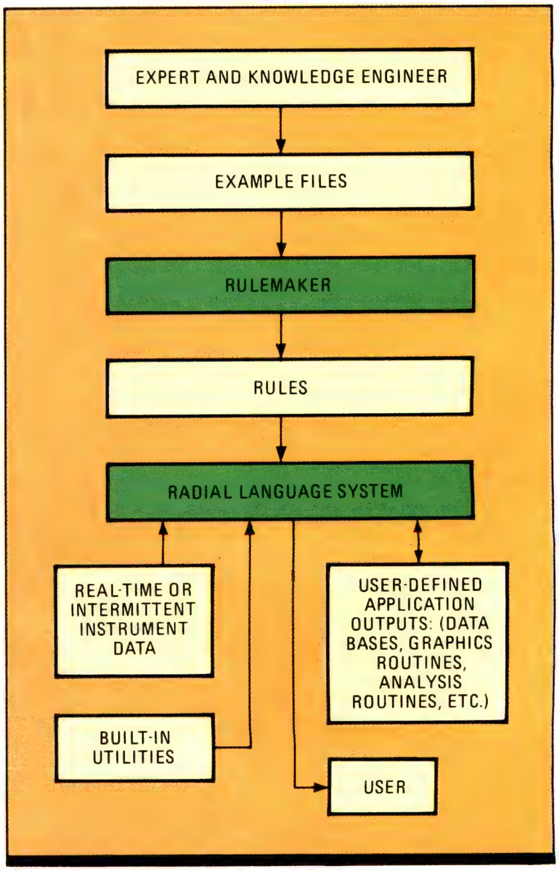
Setting an example has always been a good rule to live by. Now, good examples—rather than rules—are speeding expert-system development.

"Experts tend to relate their knowledge by examples," says Ben Finkel, marketing manager at Radian Corp., noting that human experts tend to offer copious examples when interviewed by knowledge engineers for the development of expert-system data bases.

Basing their work on that finding, Radian and artificial-intelligence pioneer Donald Michie at the University of Strathclyde in Glasgow, Scotland, teamed up several years ago to create a second-generation knowledge-engineering system that uses examples to automatically induce rules for expert systems. The result is a C-language-based system called Rulemaster. Similar to Michie's Pascal-based Expert Ease, which is being sold in Europe through the developer's own Intelligent Terminals Ltd., Rulemaster contains two key components. Rulemaker induces the rules from a table of entered examples; Radial, a proprietary high-level language, spells out the induced rules.

Rulemaster is aimed at an emerging demand for diagnostic and control applications. In December, the National Aeronautics and Space Administration's Johnson Space Center took delivery of the first Rulemaster development system to help debug the flight-control software for the space shuttles. Today, Rulemaster is installed at 20 customer sites, tackling a range of applications that includes factory control, severe-weather forecasting, medical diagnosis, and computer repair.

Diagnostic and industrial-control applications for expert systems represent one of the fastest growing segments of the AI business, believes Howard K. Dicken, president of DM Data Inc., a market researcher in Scottsdale, Ariz. Dicken thinks the expert-systems market will grow from $75 million this year to $810 million by 1990 and that control and diagnostic software will increase in market percentage from their present total of 30%. Rulemaster, according to


EXPERT AND KNOWLEDGE ENGINEER
EXAMPLE FILES
RULEMAKER
RULES
RADIAL LANGUAGE SYSTEM
REAL-TIME OR INTERMITTENT INSTRUMENT DATA
BUILT-IN UTILITIES
USER-DEFINED APPLICATION OUTPUTS: (DATA BASES, GRAPHICS ROUTINES, ANALYSIS ROUTINES, ETC.)
USER

Learning by examples. Rulemaster derives rules from examples through two main components: Rulemaker, which induces the rules from a table of examples; and the proprietary Radial language, which spells out the rules.

Dicken, is representative of second-generation system development tools aimed at speeding up data-base building.

Radian, founded 16 years ago, thinks Rulemaster will make for shorter expert-system development cycles and thus help the market achieve its potential. Instead of using an AI language such as Lisp or Prolog, Rulemaster expresses its example-generated rules in the Radial language, similar to the algorithmic structure of Pascal or Ada.

"We have completed development of our own application packages in three to six months, and we have been told that equivalent projects using rule-based programming have taken three to five times longer," Finkel claims.

Making the rules. To create an expert system, engineers first partition an application into modules of conditions, actions, and tables of examples. As examples are entered, Rulemaker creates and modifies rules expressed in Radial. During development, a knowledge programmer can ask Rulemaster to explain its actions, and new examples can amend rules for a completed package; using Radial, a programmer can also directly enter new rules.

Rulemaker sets priorities for each condition's "if-then-else" statements, reducing the number of questions asked the end user by the completed package. Radial supports both backward and forward chaining mechanisms for reasoning. Backward chaining, common in diagnostic software, is goal-directed; the system checks decision trees in a top-down manner. Forward chaining, often better suited for control applications, considers problems from the bottom up.

The resulting Rulemaster systems can run on mainframes and personal computers under AT&T Bell Laboratories' Unix operating system or Microsoft Corp.'s DOS for the single-user IBM Corp. Personal Computer/XT. Development packages for multiuser Unix 4.2-based computers start at $25,000 per central processor. Rulemaster packages for IBM's PC AT, running the Xenix version of Unix from Microsoft, cost $15,000, and a DOS version for PC/XT models is priced at $5,000. Rulemaster-based application packages for end users are typically priced from $100 to $1,000. *–J. Robert Lineback*

FRENCH FARMERS TO DIAGNOSE CROP DISEASES WITH AI

Paris

French farmers soon will begin relying on artificial-intelligence systems to boost their output in a program that will take expert-systems writing nearly to the point of mass production. Cognitech SA, a small Parisian firm founded in 1983 to develop AI programs, has been chosen by France's national agricultural research body, the Institut National de la Recherche Agricole (INRA), to develop 30 expert systems, each dedicated to the analysis and diagnosis of maladies to which one of the country's major agricultural crops are prone.

Slated for prototype operation by the end of next year, the program is to be in full swing by the middle of 1987, at which time the expert systems are expected to serve more than 10,000 French agricultural technicians and farmers. The user work station will consist of an inexpensive Minitel terminal to access the programs and an associated video-disk player for essential visual support.

The INRA's reasons for turning to AI systems are simple enough. "Each year in France between 12% and 15% of farm production is lost because it can take as much as three weeks to get a competent diagnosis and treatment information on a crop that is suffering from some kind of malady," says Jean-Michel Truong-Ngoc, president and chief executive officer of Cognitech. "Farmers are very isolated people who nonetheless need access to many different kinds of specialized information."

Cognitech will rely on one principal expert to produce each of the 30 expert systems. These experts will in turn call upon specialists for specific questions; the total number of experts involved will be about 200. In Cognitech's pilot program, for example, a system called Tom was designed to diagnose maladies affecting tomato crops; the general expert needed input from specialists in insects, viruses, fungi, and plant nutrition.

Tom is a highly interactive program based on terminology common to agricultural technicians and farmers and can be operated by persons with virtually no data-processing background. Referring to more than 200 symptoms, it can diagnose some 60 maladies, 15 of them caused by fungi and several that are bacteria-related. Having made an analysis, Tom tells the user the reliability of the diagnosis by rating it on a scale from 0 to 100 and then indicates the preferred treatment.

While working on Tom, Cognitech also produced Tigre, a set of tools for the development of diagnostic expert systems that it will use to write the other expert systems. The Tigre tools are similar to and build upon the Emycin inference system developed at Stanford University. *–Robert T. Gallagher*

PILOT PROGRAM EXAMINES TOMATO PLANTS

A look at the operation of the pilot version of Tom, a tomato-plant program, shows how the Institut National de la Recherche Agricole will make use of expert systems in the diagnosis of crop maladies.

Tom is written in Lisp, runs on INRA's Bull DPS 8 mainframe computer, and can be accessed over telephone lines using a standard Minitel terminal. Tom asks the user questions about his tomato plants, first to set the scene (determining such things as the type of plants and the place they are being grown), and then to focus on the plants' problem. Questions center on five parts of the plant—the root, the stem, the neck (the stem at earth-level), the leaves, and the fruit. Increasingly specific questions are generated as a function of the answers given.

In response to each question, the user can say yes, no, or I don't know, or he can ask the program why it wants a particular fact. In this last case, the computer tells him in which direction it is reasoning and why. The operator can then reject the path of reasoning (pointing toward a specific malady) if he is certain that it is incorrect, or he can choose to continue along the lines the computer suggests. When the program has reached a conclusion, it tells the user what the most probable diagnoses are and specifies treatments.

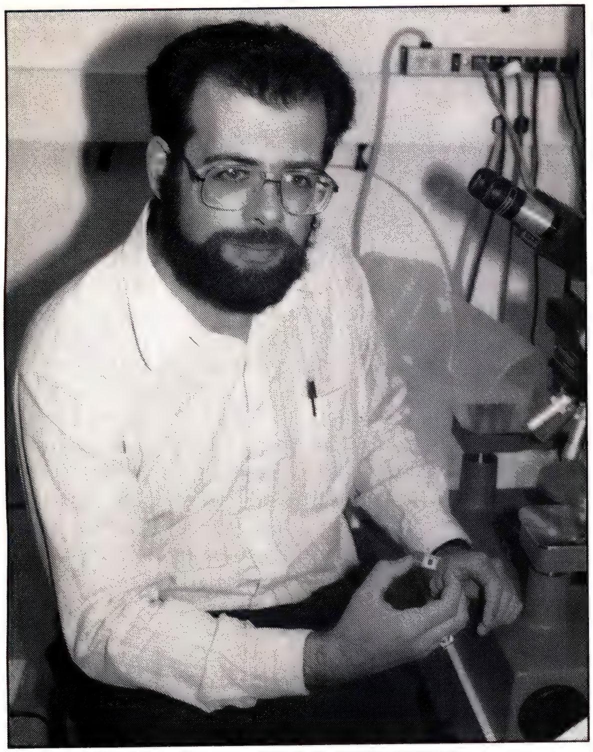
An essential part of the Cognitech approach is a video-disk system that sits next to the user's terminal and automatically displays images of the symptoms that the user is being asked about. This avoids errors because of vague descriptions of symptoms such as "spots," "faded colors," and "powdery deposits" and obviates long and confusing verbal explanations. **–R.T.G.**

MEMORIES

UV-WRITE-ENABLE MEMORY ENHANCES LOGIC CHIPS

Cambridge, Mass.

Adding modest amounts of nonvolatile, changeable memory to logic chips can be costly. Electrically erasable programmable read-only memory, for example, requires thin oxides (and often additional layers of polysilicon). Ultravi-



Memory man. Lance Glasser got the idea for ultraviolet write-enabled memory while working with an ion-beam machine.

olet-erasable EPROM is cheaper, but adding it still requires altering standard MOS processes, which can reduce chip yields.

But now a PROM has been developed at the Massachusetts Institute of Technology that allows nonvolatile memory to be added with no additional masking or processing steps—in other words, using conventional MOS processing. Called UV write-enabled PROM, the cell is similar to a standard MOS PROM's in that UV light is used to erase data; but it also requires the presence of UV light to write.

Lance Glasser, an assistant professor of electrical engineering and computer science at MIT who developed the PROM, says the design exploits the UV light's ability to excite electrons to the point where they can surmount the potential barrier at the silicon-to-silicon-dioxide interfaces.

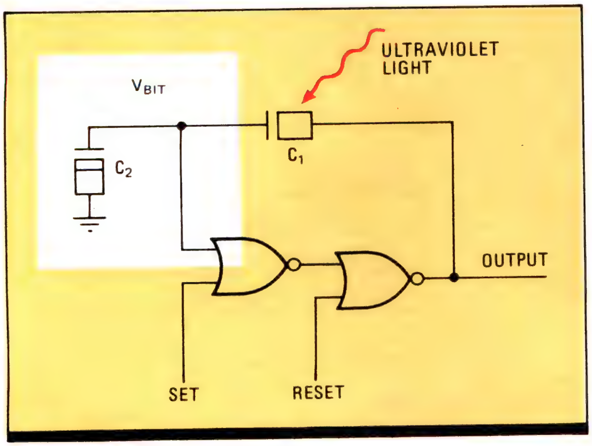
The cell incorporates two NOR gates, arranged so that only the floating gate over the MOS charge capacitor can be illuminated by UV. The other gate is shaded by aluminum metallization (see diagram). Glasser thinks this arrangement may also reduce the voltage drop at the shaded gate, which was approximately 1.5 V at a 5-V supply.

To write a "1," power to the cell's Set line is raised and the chip is flooded with UV-light. To write a "0," power to the Reset line—rather than the Set—is raised and when the UV excitation is removed, the data is stored. To write the former state, both Set and Reset are powered low while power and illumination are applied. In this case, Glasser says, the two cascaded NOR gates ensure that the last stored value is retained.

Shadow registers. Write times average about 1 h, but to speed the writing of large arrays, Glasser suggests shadow registers. They can reduce the number of input/output pins for a given write cycle. Though the devices' long-term reliability has yet to be determined, Glasser says months of storage have been demonstrated and because the storage mechanism is the same as that of commercial UV-PROMs, he expects no problems.

Glasser thought of the cell while watching the charging and discharging of floating gates in an electron beam machine at MIT's Lincoln Laboratory. Thinking about the UV-erase process, he wondered why light couldn't be used to move electrons in the opposite direction.

"Truthfully, people could have done this 15 years ago," he says, explaining that his search of the literature and patents failed to find anything similar. The development work was sponsored by the Defense Advance Research Projects Agency. MIT has filed a patent application for the cell.



In the shade. Crucial to the UV-write-enable scheme is a pair of cascaded NOR gates, one of which is shaded so that no light can reach it when the chip is illuminated.

The new cell is relatively large, requiring perhaps four times the real estate of an EEPROM. Glasser also acknowledges that for PROM only, conventional EPROM will remain the choice. But for adding small quantities of memory bits to a microprocessor, Glasser believes the UV write-enabled PROM will offer cost advantages over incorporating on-board EPROM. The storage of cryptographic codes, special addresses, calibration data and the repair locations for fault-tolerant systems are potential applications.

Jack Morgan, director of marketing for MOS memory groups at Motorola Inc. in Austin, Texas, describes the cell as "an intriguing thing to do with technology" but questions its commercial value. As the cost of EPROM technology continues to decline quickly, it "may be fixing a tire that's not flat," he says. "Industry requires thin oxides so routinely that [they] are not viewed as a cost issue. The technology is interesting, but I can't think of commercial applications." *–Craig D. Rose*

DATA COMMUNICATIONS

COMPUTERS OF DISSIMILAR MAKES CAN SWAP FILES

Paris

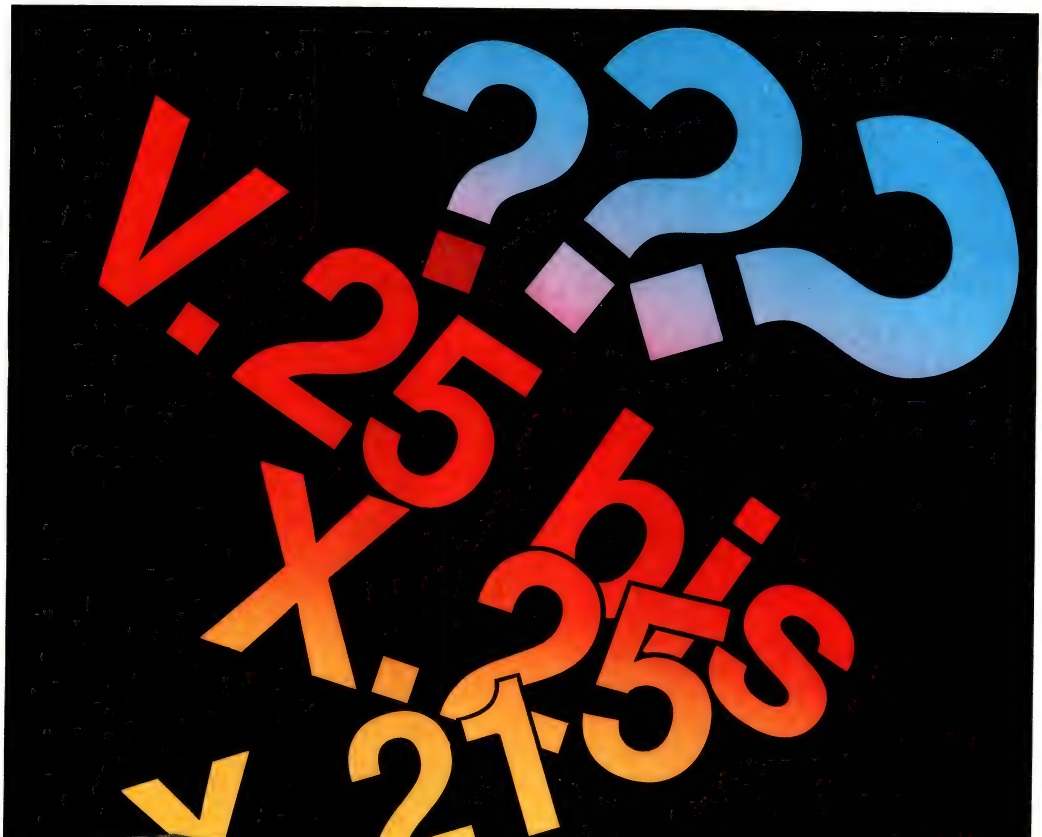
The prayers of large computer users with more than one type of system may have been answered. A French computer engineering company is ready to market a product that provides a means of transferring files between computers in a heterogeneous environment, regardless of make or network architecture.

The product, called Transnet, was developed by Société Générale de Service et de Gestion, France's second largest data-processing, engineering, and consulting firm. It is already available for IBM Corp. MVS/SP and DOS/VSE and Bull DPS7 computers. The Parisian company, which trades under the name SG2, will include the machines of most major equipment manufacturers by the end of the year.

Gaps to be filled. The exceptions are Digital Equipment Corp. and Burroughs Corp., although both gaps will be filled at an unspecified later date. Philippe Tournaud, SG2 technical director, asserts that no other company can offer a file-transfer application for such diverse equipment.

Transnet essentially effects sequential disk file transfer in pure binary code or in characters. Devoid of any master-slave notion, transfers are simultaneous and can go in either direction. Moreover, they can be instituted by either partner.

New protocols? The DA-10 can handle them



The DA-10 Data Analyser can cope with new programs to cover your special requirements and future developments.

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The DA-10 analyses and simulates interactive byte- and bit-oriented protocols. All the current interfaces, V.24/V.28, X.20/X.21, X.24, X.26/X.27, as well as any future developments, can be handled. All protocols, such as BSC, MSV, HDLC, SDLC, X.25, Teletex and Btx, are also within the scope of the DA-10.

★ **SIMULATION** makes protocol-compatible testing easy. Flexible programming, using easy-to-understand macroinstructions: SEND, RECEIVE, COMPARE DATA, as well as LOOP, JUMP, and SUB routines; TIME measurements, EVENT counting and SET protocol. It's as easy as that!

★ **ANALYSIS:** monitor operation with comprehensive triggering sequences, counter and timer functions, distortion- and bit-error measurement. X.25 format clearly displayed using mnemonics (shows levels 2 and 3 and the data simultaneously). And, everything ultra-easy to use!

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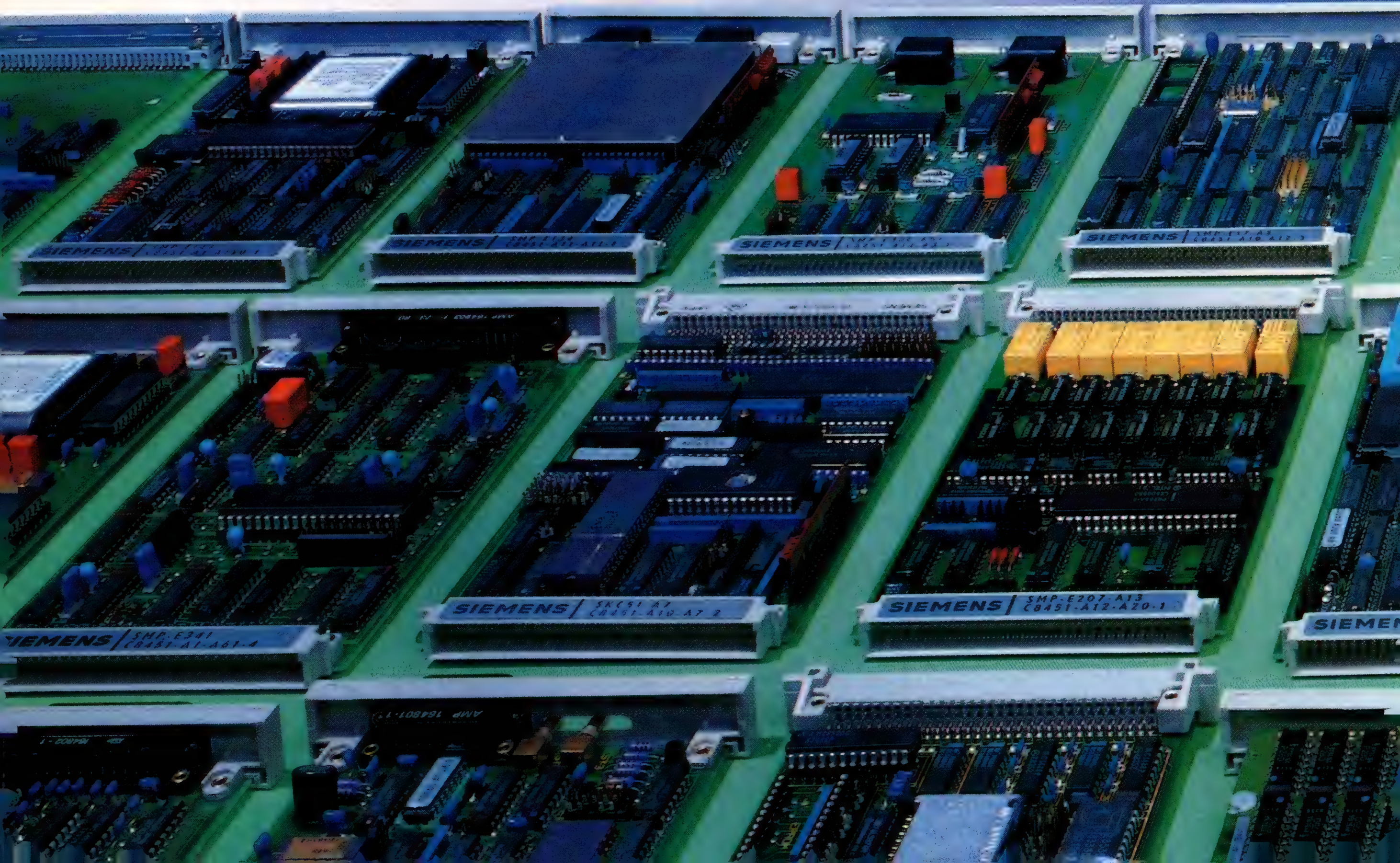

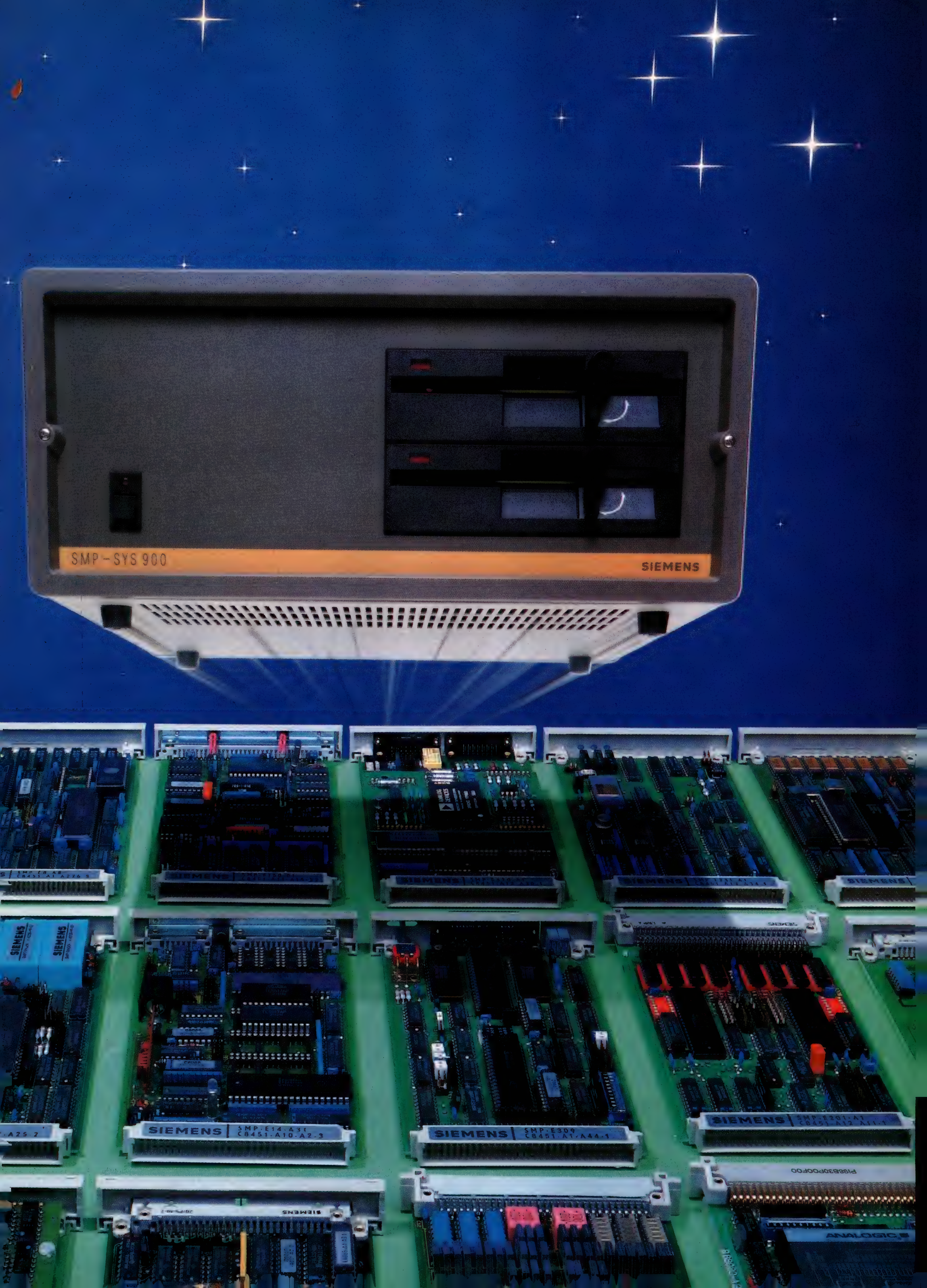
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ANALOGIC

In addition, Transnet assures transcodification to any required binary code (ASCII, for example) and provides for error correction.

In normal operation, execution is automatic—complete with display and logging of control messages, on-line interrogation of the status of transfers, and a journal file that provides a statistical résumé of transferred files. An operator can intervene on the transfer at any time.

Transnet can use any standard transmission medium to connect systems, although SG2 expects most applications to rely on X.25-type links because so many are already in place. The scheme, however, can also be used for high-speed transmission media such as the 2-Mb/s channel that is being offered by the French satellite Telecom 1.

The company claims that whatever transmission medium is used, the mechanics of the transfer exploit it at about 83% of capacity. By adding data compression, which is automatically implemented by Transnet, the transmission looks to the user as though it were realized at 120% of a line's capacity.

Transnet moves files using any standard network offered

Transnet is implemented by adding a transparent software module to the operating system of the host computers to be connected. It conforms to the first four layers of the seven-layer open-systems interconnection reference model of the International Organization for Standardization; in the absence of an OSI specification, layers five, six, and seven are based on the network-independent file-transfer protocol (NIFPT) that was developed in Britain by Cambridge University and the UK's National Physical Laboratory.

Prepared for OSI. SG2 chose the NIFPT solution because it has been stable for about three years, and the company expects that the OSI FTAM (for file transfer and manipulation) standard will, when published, be based substantially on the NIFPT approach. In any case, Transnet will be updated to conform to whatever OSI specifications are published.

Further development of Transnet is under way for IBM VM/CMS and Series 1 computers, Bull DPS8 and Mini 6, Control Data 6600, as well as Wang, Prime, and Data General minicomputer systems. It will also be available for any computer running under the Unix operating system. *–Robert T. Gallagher*

PACKAGING

INDUSTRY SPLIT ON SIZE OF 1-Mb DRAM PACKAGE

Dallas

With the plastic leaded chip carrier on its way out as the package of choice for 1-Mb dynamic random-access memories, RAM makers and buyers are at an impasse over the width of the now-favored small-outline J-leaded package (SOJ). The industry is now firmly divided on the surface-mounted SOJ: supporters of a 300-mil-wide package, and proponents of a slightly wider footprint, either 350 or 400 mils.

It is the kind of political and emotional issue facing the industry at almost every DRAM density generation since the 4-K days, reminds David C. Ford, chairman of the Joint Electron Device Engineering Council's 43.2 memory panel. Some members say the committee is hopelessly deadlocked on the SOJ issue.

Support. Since the emergence of the dispute between the plastic leaded chip carrier and the SOJ last fall, the Jedec group has sent the matter to a special task force. But after the spring meeting in New Orleans, many 43.2 committee members believe the SOJ, which was proposed and lobbied for by Texas Instruments Inc. last year [*ElectronicsWeek*, Sept. 3, 1984, p. 34], has the support to reshape 1-Mb packaging.

Unlike the plastic leaded chip carrier, which gained popularity at the 256-K stage, the SOJ has a plastic profile similar to older dual in-line packages. Like rectangular DIPs, SOJs have leads lined up in parallel along the two long sides; plastic leaded chip carriers have even numbers of J-leads on all four sides.

Three TI arguments persuaded SOJ opponents to give in: board layout efficiencies increase with the leads on only two sides, SOJ dies would more easily fit into still-pervasive through-hole DIPs, and IBM Corp. favored the small-outline package. The 300-mil-wide package is backed by TI, IBM, a number of Japanese vendors, and, most recently, Motorola Inc., which had favored the plastic leaded chip carrier.

Break with the past. "The feeling among some committee members is that if the industry is going to make a big package change, it should also break with the past 300-mil-wide packages, setting a wider standard that presents no constraints on future performance," explains Ford.

Although no official 43.2 panel vote has been taken, the apparent demise of the plastic leaded chip carrier and the swing of support behind the SOJ has sent megabit-design teams at some firms scrambling to reshape layouts for the oblong cavity. However, several will not fit in the 300-mil package.

Proponents of a wider SOJ worry that a long, narrow cavity will hamper access speeds of future 1-Mb generations, such as by-8-bit RAMs. Others argue the 300-mil-wide SOJ will likely be a one-generation standard; the future 4-Mb dies will need more room, thereby slowing assembly automation for surface-mounted components.

One backer of a 350-mil SOJ, wishing to remain anonymous because of restrictions about disclosing Jedec panel discussions, believes the issue will not be resolved before the introductions of 1-Mb products. "TI and the Japanese companies backing the 300-mil package are keeping it from a vote, and once 1-Mb chips are on the market, the 300-mil SOJs will become a de facto standard," he complains. *–J. Robert Lineback*

NEWS BRIEFS

Hard sell takes over as phone-sales boom ends

The telephone-buying frenzy of 1982-83, when consumers switched from leased to purchased phones, has ended, says Venture Development Corp. of Wellesley, Mass. It expects retail phone shipments to average a modest 4.9% annual growth rate in units through 1990. However, adds Venture Development, there is some good news: the troubles of 1984, when red inked drowned many companies, are also over and the market is moving toward stability.

Europe may see pirate broadcasting satellites

Europe, accustomed to pirate radio stations, now faces the threat of pirate satellites. International Resource Development Inc. of Norwalk, Conn., says that frustration with the politics of European satellite broadcasting may spur a company—or a nation—to orbit a bird of its own to broadcast news and entertainment across the continent.

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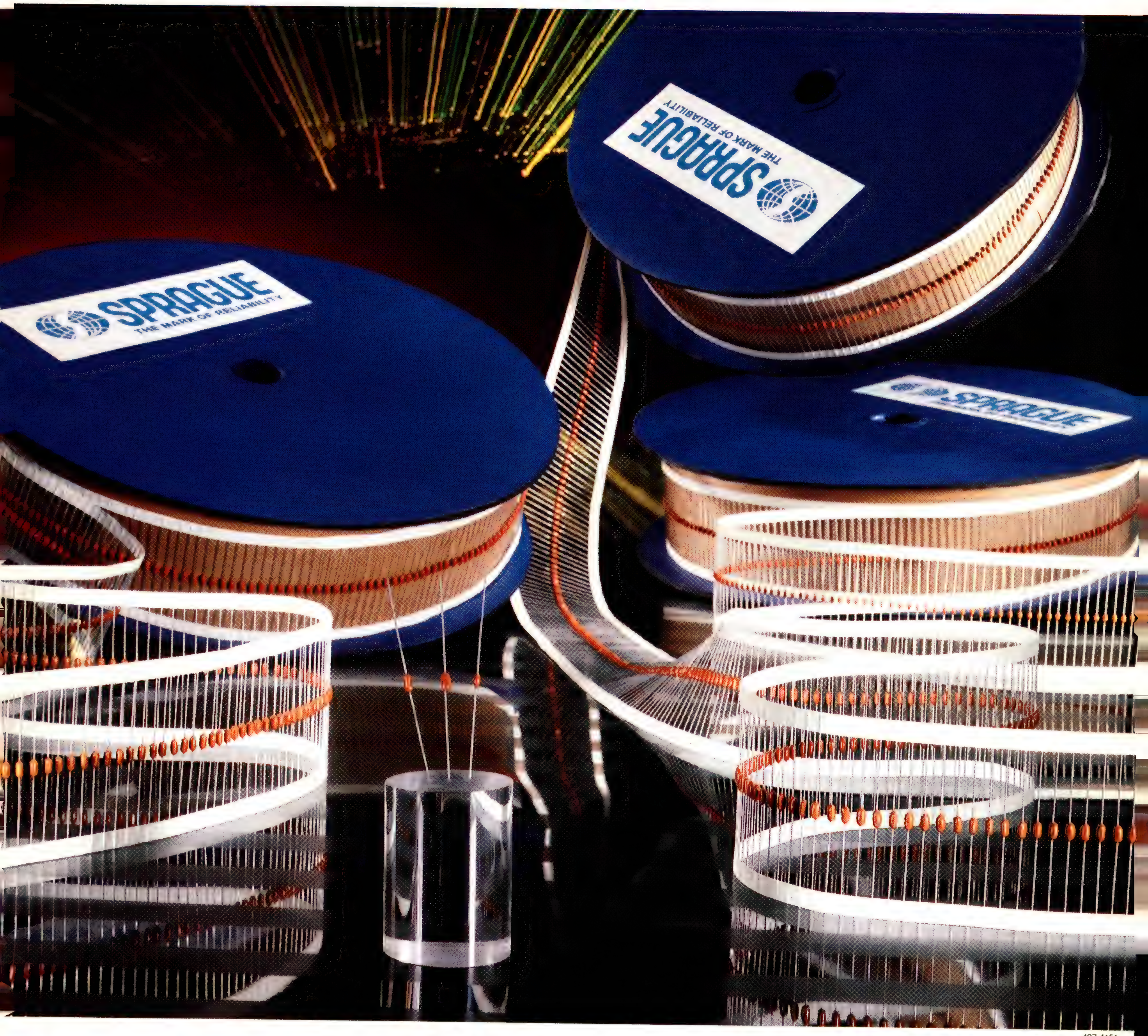

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NEDIPS was originally developed for processing image data from satellite-borne synthetic aperture radar. It has reduced processing time to about 3 hours from over 100 hours required by conventional mainframes.

Our data-flow computer features three advantages over sequential processing. First, system performance is virtually unlimited by memory input/output speed. Instructions are executed in parallel automatically. Programming and debugging are easy because it adopts a functional language.

NEDIPS, with a minicomputer like NEC's MS serving as a host computer, consists of an efficient data-flow processor and memory subsystem which is expandable to 64 Mbytes. Maximum processing speed is 159 MFLOPS. Superior speed and programming ease make the system highly suitable for diverse scientific calculations such as dynamics simulation and differential equations, signal processing and general image processing.

NUMBER 133

V20/V30 FEATURE EXTENSIVE CMOS PERIPHERALS.

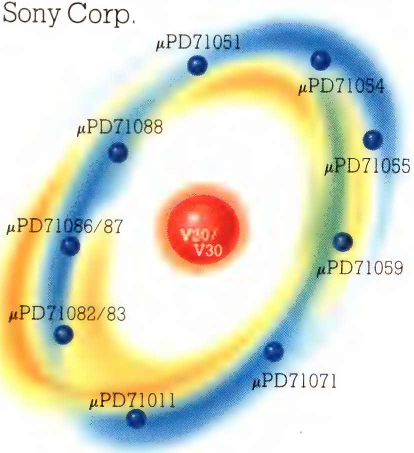
The first 16-bit members of NEC's V-Series CMOS microprocessor family are available with CMOS peripherals. The 8-bit external bus V20 and full 16-bit V30 fit into most existing systems and upgrade performance substantially.

The V20 and V30 feature dual data bus architecture and other hardware refinements to provide outstanding speed. The 101-instruction set includes bit operations, bit field operations, packed decimal operations and stack manipulations. Power consumption rates a low 300mW in operation and 50mW for standby.

Comprehensive CMOS peripherals complement CMOS V20/V30. A CMOS coprocessor (floating point processor) and advanced DMA controller are well under development.

System performance is further boosted with a multi-tasking Real Time OS. Development tools include an In-Circuit Emulator, Relocatable Assembler, Pascal and C compilers.

The V20 and V30 are to be alternately sourced by Zilog Inc., and Sony Corp.



LARGE-CAPACITY INFORMATION DISPLAY PAGER.

The new NEC D4α Information Display Pager packs state-of-the-art technology into a credit card-sized unit weighing only 100 g (3.5 oz).

It receives, displays, and saves a total of 12 messages up to a maximum total of 416 characters. The maximum single message length is 352 characters. Each message appears on the 5 × 7 dot matrix Liquid Crystal Display (LCD), 16 characters at a time. These features enable detailed messages or instructions to be communicated to the IDP user.

Up to eight current messages can be saved and recalled from the PORTAL memory. An additional four important messages can be selectively shifted to the VAULT memory, which protects them from being overwritten.

The two unique addresses assigned to each unit provide both information display and priority tone-only services to the users.

One of four optional alert modes is selectively programmed into each unit. The "Silent Secretary" mode delays received messages until it is convenient for the user to review them. Also, the number of messages received while in this mode will be displayed on the LCD. "Visual Alert", with a blinking red LED, displays and saves incoming messages in memory. "Quiet Alert" sounds a low-level alert tone. "Vibration Alert" blinks the LED and vibrates while it displays and saves incoming messages.

NEC TO SUPPLY FIVE EUTELSAT AND TWO SMS EARTH STATIONS.

As part of the European Communications Satellite (ECS) System, NEC is supplying earth stations for five member nations of the European Telecommunications Satellite Organization (EUTELSAT). Austria, Portugal, Switzerland and Turkey have ordered complete satellite communications systems, including TDMA/DSI (digital speech interpolation) terminal equipment. NEC has already supplied to Belgium a high-performance 18-meter diameter dish antenna and low-noise amplifier subsystems.

The latest digital technology will be used for telephone transmission to effectively use satellite transponders. The TDMA/DSI system will permit each station to transmit for a fraction of a second using the whole bandwidth of the transponder. The EUTELSAT series of satellites also forms a special network called the Satellite Multi-Service (SMS) System primarily for business users. NEC has also received orders for two SMS and two TV uplink earth stations from Norway.

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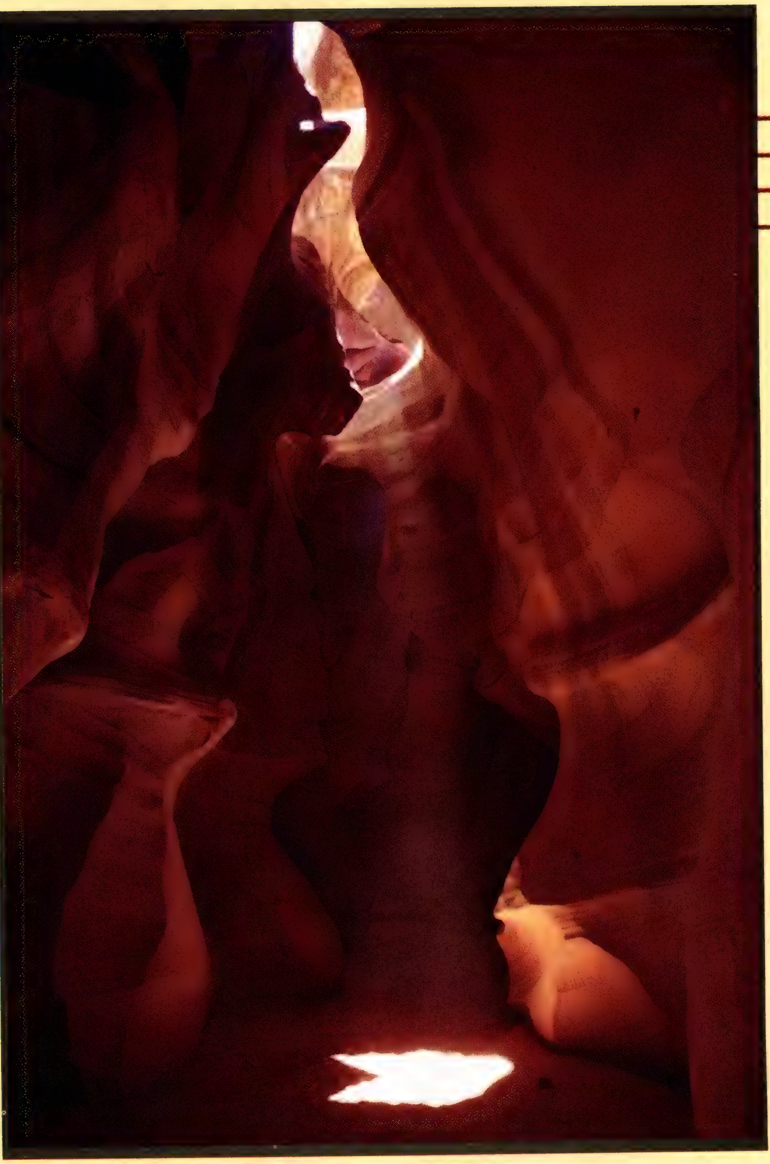

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AT&T PACT COULD SIGNAL SURGE IN CORPORATE BYPASS

by George Leopold

LINK TO NEW N.Y. BUILDING IS EX-PARENT'S FIRST SNUB OF A REGIONAL COMPANY

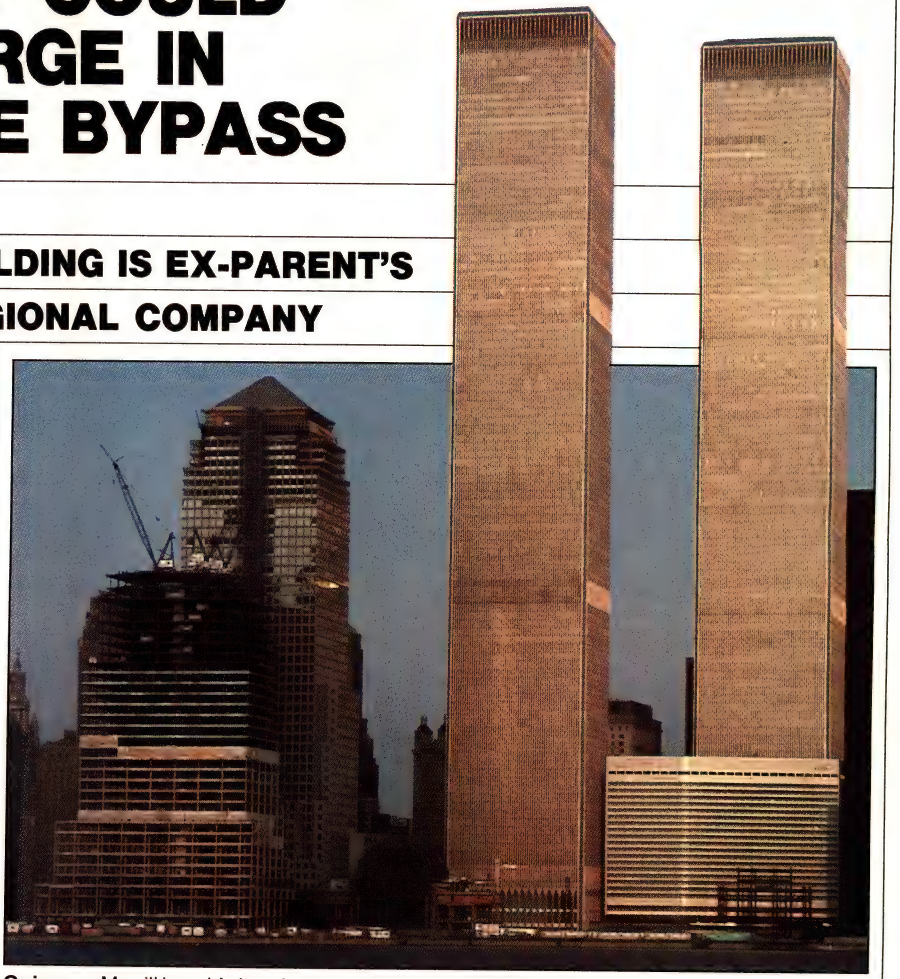
New York

AT&T Co. sent shock tremors through the telecommunications industry earlier this month when it announced plans to bypass the lines of one of its former Bell operating company subsidiaries for the first time. The decision will probably provide further impetus for large corporate customers to use facilities other than those of the regional Bell operating companies when the newly divested organizations are already scrambling to cope with various bypass technologies.

Under terms of the agreement announced May 2, AT&T Communications Inc., the long-distance arm of AT&T, will provide Wall Street giant Merrill Lynch & Co. with long-distance service through an optical-fiber communications link supplied by Teleport Communications. Service is expected to begin in September. In leasing access to the network, AT&T will bypass New York Telephone Co., a unit of the Nynex Corp., which covers New York state and New England.

Using influence. The Teleport, which is based on Staten Island just across New York harbor from Merrill Lynch's new headquarters in the World Financial Center in lower Manhattan, is a joint venture between Merrill Lynch and Western Union Corp. That relationship apparently had plenty of influence on the decision by AT&T to use the Teleport rather than to go through the local telephone company.

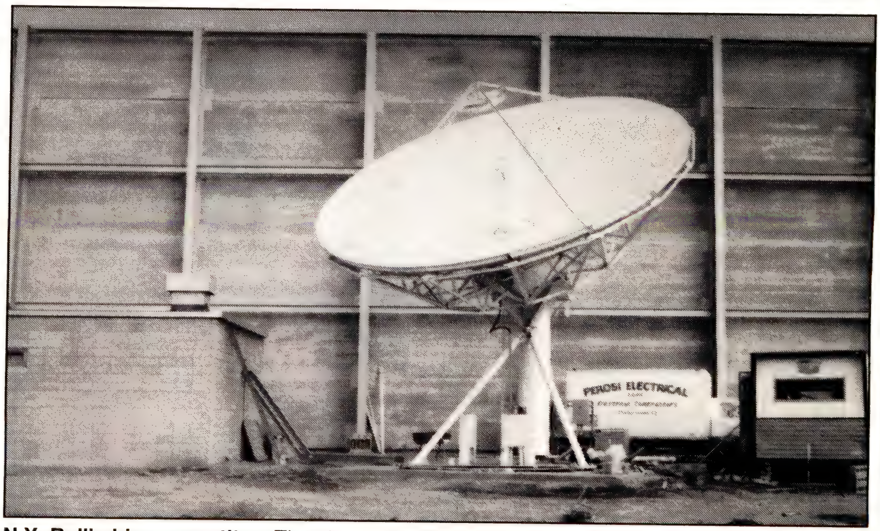
That relationship is alluded to by AT&T itself. Although Jerry Thames, general manager of network services for AT&T Communications, emphasizes that the long-distance carrier will continue to adhere to its policy of seeking access to customers through the regional Bell companies wherever possible, he quickly adds that the former parent must also serve customers' needs. And in the case of Merrill Lynch and the new headquarters building, Thames continues, “we had a customer-driven situation.”



Going up. Merrill Lynch's headquarters, under construction alongside the World Trade Center, will have AT&T long-distance service that bypasses the New York phone company.

Further playing down assertions that the Merrill Lynch deal represents a significant shift in AT&T's policy of sticking to the regionals, Thames characterizes the agreement as merely “the first time we have purchased access [to the customer] from somebody other than the regionals.”

He says AT&T will be able to provide its new customer with voice and data



N.Y. Bell's big competitor. The size of the Teleport can be judged by contrasting the wall around it with the truck and antenna. It is a joint venture of Merrill Lynch and Western Union.

transmission service by August and further hints that the telecommunications giant's full range of services could be available to other customers during the first quarter of next year.

When the agreement was announced, New York Telephone said only that it was evaluating the impact of the agreement on itself and its customers. Since then, it has not elaborated on that statement. And although none of the parties to the agreement is willing to discuss the precise amount of money involved, Merrill Lynch's long-distance savings are expected to be well worth its investment in the fiber-optic link. "I would think it's a considerable saving" to Merrill Lynch, says John Reiser, Teleport's vice president of sales and marketing.

The new Merrill Lynch headquarters will be one of more than 20 buildings in Manhattan already served by the Teleport's 220-km fiber-optic network that is expected to stretch as far south as Princeton, N.J., some 60 miles, by next month. According to Reiser, the wideband, laser-powered network will provide Merrill Lynch with both voice and high-speed data communications at T3 rates of 45 Mb/s. That works out to 703 voice channels.

Using the fiber-optic link, AT&T will provide local point-to-point access between the World Financial Center, a complex of four buildings, and an AT&T network service facility that is also located in lower Manhattan. The configuration will not include microwave, Thames of AT&T notes.

Indeed, the agreement is one of several in the New York metropolitan area that will bypass the local loop to transmit voice and data. The Teleport, which is also building a complex of satellite receiving dishes on Staten Island, has also agreed to link Dow Jones & Co.'s Princeton offices and its new headquarters in the World Financial Center. That link will involve bypassing both New Jersey Bell Telephone and New York Telephone.

Other technologies. Dow Jones Inc. is also using other bypass technologies. According to James Weinrebe, a spokesman for Mutual Satellite Service of Arlington, Va., Dow Jones has signed on to distribute its news service using Mutual's FM subcarrier service. Beginning this month, Mutual will distribute the Dow Jones News Service in New York on a trial basis. Distribution could be expanded to more than 2,000 points in the 10 largest U.S. markets by October, Weinrebe claims.

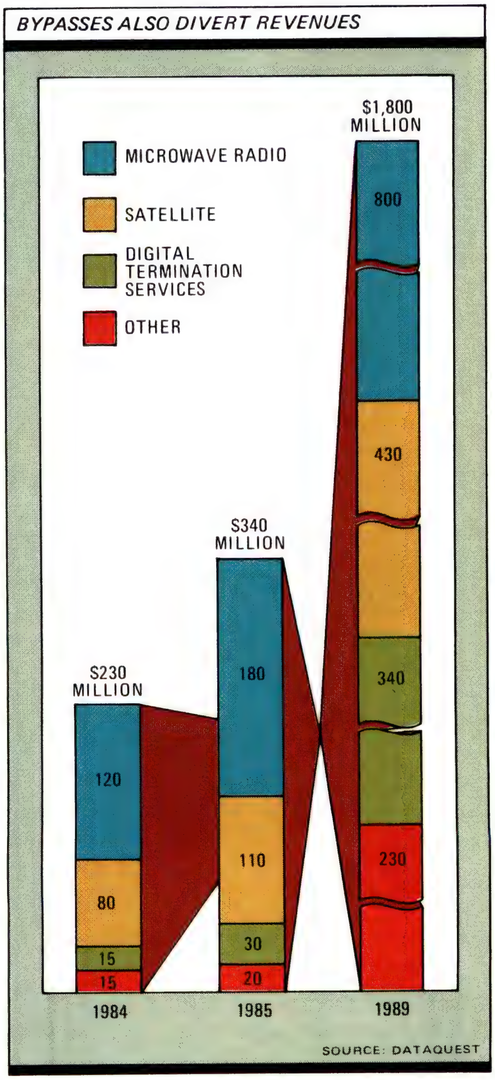
The point-to-multipoint service, called Multicomm, was developed to transmit encoded information in data, audio, and software formats at speeds of up to 9,600 b/s. It uses a proprietary error-detection and -correction algorithm to provide low bit-error rates. Weinrebe says 56-kb/s transmission speeds are planned for users seeking faster rates to fewer points.

Big savings. Referring to the potential market for this bypass technology, he adds that the FM subcarrier service is aimed at "any organization that wants to go point-to-multipoint but is tied up in telephone lines." Depending on the number of locations served, he estimates that users such as Dow Jones could save from 20% to 50% by bypassing the local telephone companies.

Complicating matters further for the regionals is a Federal Communications Commission decision, announced April 19, approving new tariffs for AT&T's private lines, a service that provides continuous links between remote offices. The unanimous ruling permits customers to bypass local phone companies through links with AT&T's long-distance network.

In the past, Bell company officials have warned that large-scale bypass of the public-switched network will endanger universal telephone service [*ElectronicsWeek*, Feb. 11, 1985, p. 25]. If AT&T is permitted to bypass the regionals with services such as WATS lines and toll-free 800 service, the resulting loss of revenues could lend credence to the claims of telephone company officials that residential customers would have to bear the financial burden of supporting the network.

BYPASSES ALSO DIVERT REVENUES



SOURCE: DATAQUEST

Bypass "has the potential to be a problem for the telephone companies," says Kenneth M. Leon, a telecommunications analyst with investment banker L.F. Rothschild Unterberg Towbin in New York. "Merrill Lynch has put its money where its mouth is." Moreover, Leon thinks the AT&T-Merrill Lynch bypass pact is "an indication of where the industry is going."

A costly procedure. The agreement "shows the viability of bypass as a technology and as a service," concurs Victor Krueger, vice president of telecommunications industry services for Dataquest Inc., a San Jose, Calif., market-research firm. Krueger estimates that bypass could divert $1.8 billion in phone company revenues by 1989, up from $340 million this year (see table). He pegs the compound annual growth rate for bypass from now until 1989 at a healthy 51.7%.

Furthermore, Krueger thinks the regional companies such as Nynex, which serve highly concentrated groups of corporate customers, are particularly vulnerable to bypass strategies. "A small percentage of companies wanting to bypass could have a significant effect on Nynex's revenue," he says. "In the longer term, the phone companies won't be sitting idly by."

That also applies to bypass providers such as the Teleport. Besides AT&T and Dow Jones, spokesman Reiser says the Teleport has already reached agreements to use the fiber-optic network with Satellite Business Systems, a joint venture between IBM, Aetna Life & Casualty, FTC Communications, Banker's Trust, and others. Reiser adds that negotiations are nearly complete with other Manhattan firms.

Elsewhere in the battle for long-distance customers, the Justice Department announced May 16 that it will investigate how an AT&T computer-programming error may have resulted in the misallocation of about 11,000 lines claimed by MCI Communications Corp. to New York Telephone.

The investigation results from a complaint filed by MCI. A New York Telephone spokesman says identifying and notifying the specific customers involved in the matter will take several weeks. ☐

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TELECOM GIANTS EDGE CLOSER TO DOMINATION OF WORLD MARKETS

by Kevin Smith

BRITISH TELECOM'S ACQUISITION OF MITEL IS A HARBINGER OF MORE MERGERS AND AN INEVITABLE SHAKEOUT

London

The world's telecommunications industry has received another push down the road to a future when a handful of giant multinational companies, combining skills in telecommunications and data processing, will dominate a single worldwide market. The latest impetus comes from British Telecommunications plc's $218 million bid for Mitel Inc., the Canadian maker of private branch exchanges, or PBXs [*ElectronicsWeek*, May 20, 1985, p. 24].

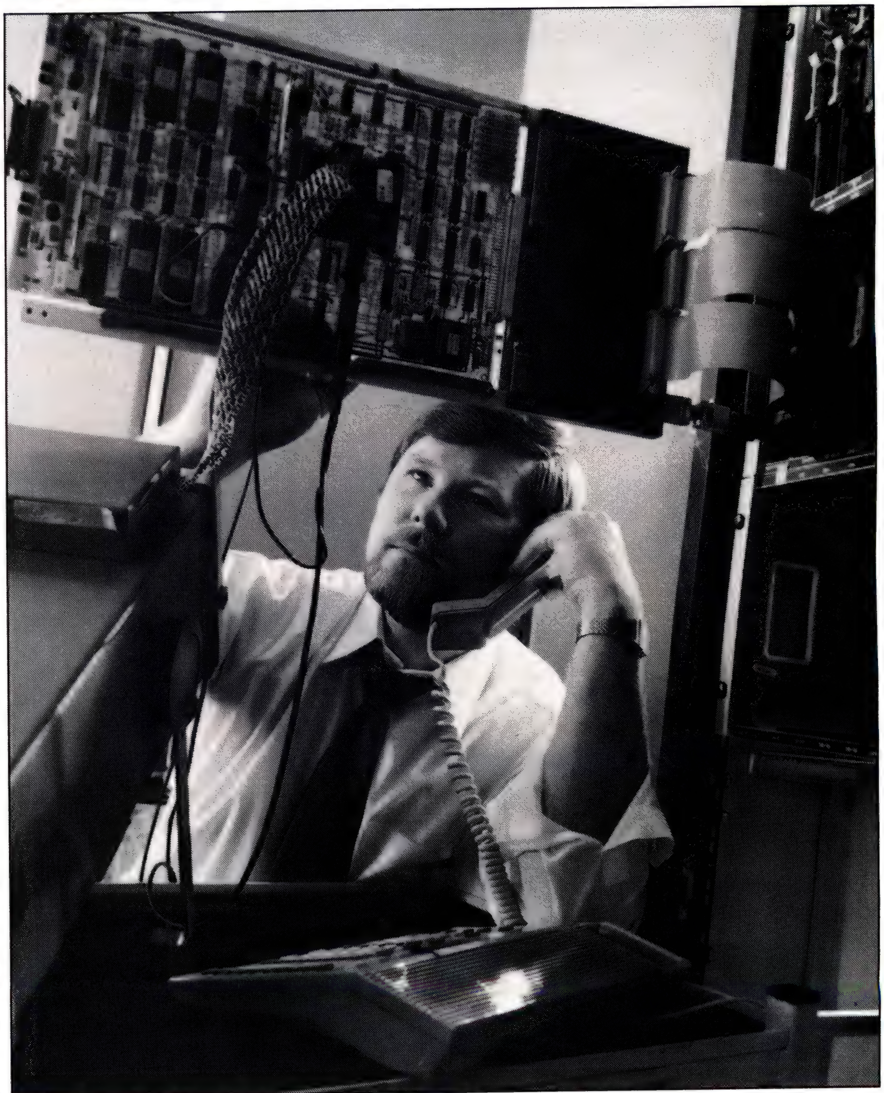
Three powerful forces are driving the industry in that direction.

- The convergence of telecommunications and data processing is forcing members of both camps into defensive alliances.
- National barriers are breaking down to form a worldwide market; only the biggest will survive in this arena, so companies are rushing to form international alliances.
- The escalating cost of developing large public exchanges must hasten a shakeout of switch suppliers.

Two of those conditions, the alliance-making and mergers, are already well established. All that remains is a shakeout of the weakest players.

At the top of the ladder, AT&T Co. is looking to expand overseas by teaming up with N.V. Philips of the Netherlands on telecommunications gear and with Italy's Ing. C. Olivetti & C. SpA on business systems. Meanwhile, IBM Corp. has bought Rolm Corp., the PBX maker, and a raft of lesser computer makers have tied up with PBX suppliers including Britain's International Computers Ltd. plc, which distributes the Mitel SX-2000 digital switch.

In Europe, Thomson-CSF, Siemens AG, Italtel SpA, and Plessey Co. plc have agreed to collaborate on exchange development. At the same time, the European Communities may fund a $400 million program, called RACE, to research next-generation wideband communications networks.



The magician. A technician works on British Telecom's Merlin Monarch PBX switchboard, which has chalked up 10,000 installations in the UK. It can accommodate 64 outside lines.

Now, with its offer for 51% of Mitel, British Telecom wants to control the last independent North American PBX maker and thus move up to play with the big boys. Not that the London firm is a pygmy: British Telecom is one of the world's top four network operators, with sales of $8.75 billion. With Mitel's PBXs approved for attachment in more than 60 countries (more than 40% of its sales are outside North America), the company is poised to go global.

The emergence of British Telecom as an aggressive international company is one unexpected consequence of the British government's deregulation policies. The government wanted to create a home market like that in the U.S., one that would encourage entrepreneurially minded companies to seize and exploit the opportunities created by the convergence of communications and computer technologies.

Six months ago, the government's plans reached fruition when it turned British Telecom into a public company, selling it off for a whopping $1.62 billion. Earlier still, the government created the Office of Telecommunications (Oftel) to watch over the newly deregulated industry even as it sanctioned a second network operator, Mercury Telecommunications Ltd., to compete with British Telecom.

But much to the government's surprise, the most aggressive competitor to emerge from deregulation has been British Telecom itself. Having won a hard fight to keep itself from being dismembered, as was AT&T, it now wants to throw its weight around overseas. But some suspect it has predatory intentions at home.

British Telecom now has enormous discretionary powers as a private company, and the government may have a tiger by the tail. With sales of nearly $9 billion, it is one of the few British technology-based companies with the financial muscle to compete successfully overseas.

Looking abroad. Also, as a private company with a charter to make profits, British Telecom can no longer afford to coddle UK suppliers and is cutting loose the umbilical cord that has supported them, probably an advantage to both. British companies complain that British Telecom gear was overspecified and unsalable, while the company was never sure that it was not overpaying.

Now British Telecom buys both public and private exchanges from UK and overseas suppliers. Recently, for example, Thorn Ericcson Telecommunications Ltd., a joint venture between UK and Swedish companies, agreed to supply up to 30% of British Telecom's main exchange requirement in competition with System X, a digital exchange developed by British industry in collaboration with British Telecom. Also, British Telecom bought some equipment from AT&T and Philips Telecommunications B.V. for a new toll-free service.

To add to the traumas of deregulation, British manufacturers must now come to terms with a network operator that can manufacture its own equipment. In theory, British Telecom could use its newfound manufacturing capability to make public as well as private exchanges, like Western Electric, AT&T's manufacturing arm. It already sells Mitel products and could increase production at Mitel's South Wales plant.

Some analysts see this as a very real threat. John Buckley, a senior consultant for PA Computers & Telecommunications Ltd., says, "the prospects for Plessey and GEC [General Electric Co. plc] in the long term are dim. British Telecom will buy exchanges off itself rather than go to competitors. We will see a shakeout in the PBX market sooner than later."

But Jefferson counters that "we could not expect the Mitel product to take an excessive share of the UK market." The Mitel switch, together with two of British Telecom's designs, account for one third of British Telecom's PBX sales; Jefferson expects this figure to remain much the same.

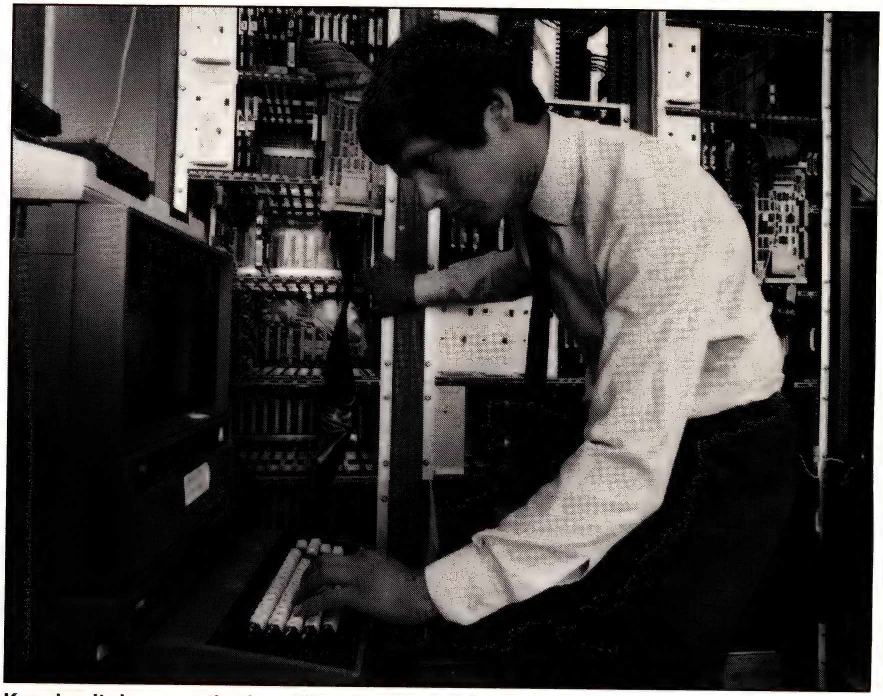
Nevertheless, the UK market is no longer the soft touch it once was and British companies must look elsewhere for their salvation. Plessey, as lead contractor on System X and with the biggest share of the UK market for digital PBX exchanges, is the strongest of the British trio of traditional suppliers to British Telecom. Through its 1982 acquisition of Stromberg-Carlson, Plessey has gained a foothold in the U.S. Even so, it is still one of the smaller players and will have to build on its recent accord with its European partners to collaborate on digital-exchange development.

Standard Telephones & Cables plc, having recently purchased ICL, could initially gain by the deal, but in the long run there may be a fundamental conflict of interests: STC manufactures some PBX equipment and still has close links with ITT. ICL has built its office-automation strategy around the Mitel SX-2000 digital switch, so it could benefit.

But as the industry struggles to keep abreast of changes, a long-term deal that brings three UK companies and one Canadian firm together is in the cards. The direction of the agreement, says STC, "is a matter for discussion between ICL, Mitel, and British Telecom." Meanwhile, GEC, Britain's largest electrical and electronics group, will likely become increasingly dependent on technology links with Northern Telecom Ltd. of Canada.

British Telecom seems to be Britain's best hope for success in world telecommunications markets. But it has yet to be seen if the company, after being a government department, has the management know-how to turn Mitel around and exploit its overseas marketing operations; few doubt it has the financial resources.

Jefferson thinks Mitel is strong on technology and manufacturing but lacked the muscle to market its products worldwide. British Telecom's cash reserves will let Mitel develop its marketing, and "the financial injection will give great confidence to customers. We are not looking at it in terms of what will happen in the next 12 months. We see it as a strategic move that will start to bear fruit in three to five years' time. One of the attractions of the company is that the manufacturing managers are still there." □



Keeping it down on the farm. Paul Trudgett, of British Telecom's Martlesham Heath labs, debugs a UXD5 PBX, designed to bring the advantages of digital switching to rural areas.

HOME COMPUTER MAKERS ANXIOUSLY SEEK JOBS FOR MACHINES

by Denise Caruso

APPLE, COMMODORE, TANDY, AND COMPETITORS TRY A VARIETY OF APPROACHES, ADDING FUNCTIONALITY AND UPGRADES

Palo Alto

Despite an unparalleled industry slowdown, another Consumer Electronics Show will open June 2 in Chicago, and show organizers say exhibit space is at a premium.

Around the U.S., home computer companies such as Apple Computer, Atari, and Commodore International are grooming highly capable new machines—while admitting that consumers still haven't figured out what to do with the old ones. (Most experts agree that home computers are those selling for up to about $1,000 or $1,200. There are 10.5 million in use in U.S. homes and another million gathering dust, estimates Ann Wujcik, director of educational projects at Link Resources Inc.)

"If we want to be successful in the consumer market and grow with it, we have to define [a home computer's] value," declares Delbert Yocam, leader of the Apple II Division for Apple Computer Inc. "Much more needs to be done in terms of applications." Yocam calls for application software that "adds real value to people's lives."

Yocam's message is becoming increasingly important as Apple's polished corporate image becomes tarnished. Reports of slackened sales, layoffs, high turnover, and stock sales by upper management, and rumors of a takeover by a corporate giant such as General Electric, AT&T, or General Motors have shaken the morale of employees and stockholders alike. But despite these widely publicized events, sales continue to plug along respectably.

In April, Apple's IIe and IIc accounted for 22% of total market share in computer specialty stores while competing for attention with more sophisticated systems such as IBM Corp.'s Personal Computer line, according to Infocorp, a market research firm. The Apple II family sells on a much smaller scale in mass merchandise outlets as well.

However, archrival IBM's attempt to enter the home computer market with the ill-fated PCjr has been judged by many observers to be a dismal failure. The PCjr was cut from IBM's product line in March.

"It was electric shock treatment," says Brian Jeffery, director of research for International Technology Group. "The minute IBM stopped throwing money at it, it stopped selling." Jeffery doubts that IBM will ever reenter the market with a machine specially designed for the home. The market, he believes, "is far too volatile for IBM." But price cuts will soon bring the entry-level price for a standard IBM PC down to about $1,000, he noted. An IBM spokesperson declined to comment on any of IBM's plans, although speculation about the coming PC2, believed to be a desktop work station, is rampant.

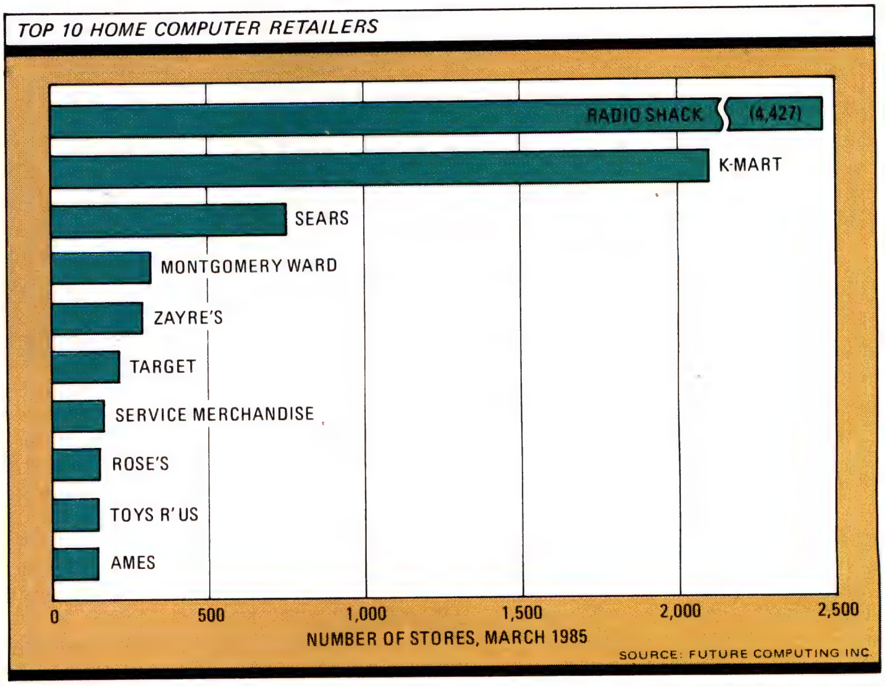
Jeffery claims the PCjr never made a profit. On the other hand, Apple has found a healthy cash cow in the low-end Apple II family. It accounts for about 50% of the entire company's revenue and receives more than 40% of its research and development funds.

The functionality that Yocam and others have clamored for is coming. Apple recently watched a presentation from two Japanese manufacturers of readers and writers for laser cards that can hold 2 megabytes of information on a credit-card-sized rectangle made of the same material used for optical disks. Yocam would not comment, but it is believed that Apple is only one manufacturer looking at such technology. Right now, that enthusiasm is dampened by price and the risk of consumer rejection.

Aggressive. "We're excited about new technologies and things that are coming out," says Yocam. "We'll be very aggressive about things that fit into our strategic directions."

One idea that evidently fits into Apple's strategic direction is the smart-home concept being developed by the National Association of Home Builders' Research Foundation in Washington. Others, such as General Electric Co. and Apple's cofounder Steve Wozniak, who left the company, are designing products that allow home electric wiring—and sometimes telephone systems—to

TOP 10 HOME COMPUTER RETAILERS



SOURCE: FUTURE COMPUTING INC.

be incorporated under a microcontroller. Tandy Corp.'s $100 8-bit Color Computer can perform such tasks as well, with modification to existing wiring, but chairman John Roach isn't sure he sees the point of it.

"I have a problem with a lot of that stuff," he says. "The problem in the home is not providing logical functions. It's what you're going to do with the information once you've got it. So it's cooler outside than inside—how are you going to open the window? You can design something exotic when you build it from scratch, but go to your house or apartment now and try to figure out how much better off you are by being a little smarter."

Going upscale. Commodore International Ltd. will soon be addressing the home market from different standpoints as well. It hopes that at least 15% of its 3 million-strong user base will upgrade from its $150 Commodore 64 to the newly announced Commodore 128, which sports a souped-up 6502 chip, Z80 coprocessor, bit-mapped graphics, and expandability from 128-K bytes to 512-K bytes of random-access memory, all for $259 to $289.

Commodore's bombshell, though, is its upcoming Amiga, shown in its prototype stages nearly a year ago and which was expected to have been released in January. The Amiga is driven by a Motorola 68000 microprocessor—as Apple's Macintosh is—and uses its own operating system.

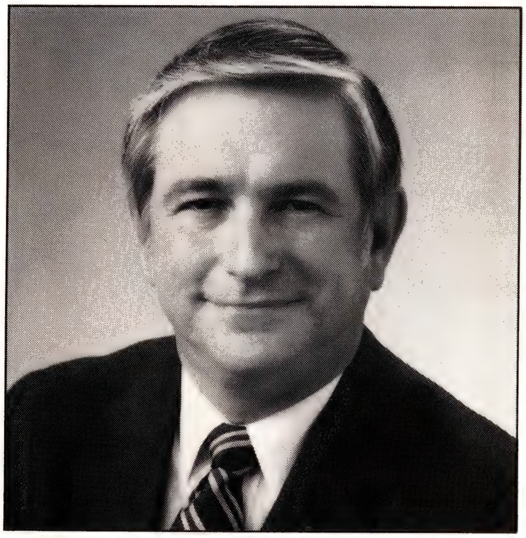
The 32-bit computer is said to sport three additional custom very large-scale-integrated circuits for animation, bit-mapped graphics, and input/output (which also controls stereo sound). A color monitor, though not included, will support 640 by 400 pixels and more than 100 colors. The extra chips allow the 68000 to be used only about a tenth of the time for fast execution of applications programs. Reportedly, it can address 8 megabytes of memory. Base configuration of random-access memory will be less than 512-K bytes but expandable to far more. Its cost will be between $1,000 and $1,500.

Despite rumors that the company was having problems developing the operating system and that the original price had increased from $1,000 to $1,500, analysts continue to be impressed. "The Amiga is an extremely exciting machine," says Jan Lewis of Infocorp. "It's such a spectacular product. It will attract a lot of attention even at a higher price point than the Atari."

Amiga will directly compete with Atari's 520ST, selectively shown at the recent Comdex/Spring. The 32-bit ST, with 512-K bytes of RAM, is jammed with such features as an RS-232-C port, a Centronix parallel port, a read-only-memory cartridge slot, a Musical Instrument Digital Interface, joystick or mouse port, and a single 3½-in. hard-shelled floppy-disk drive that connects to a direct-memory-access port. With a monitor, the system will cost $799.

But as Atari shifts into gear for the ST's shipment, uncertainty reigns over when products will be available and who will sell them. Local newspapers report severe cash-flow problems for the Sunnyvale, Calif., company. Chairman Jack Tramiel, once head of archrival Commodore, faces a deluge of lawsuits from suppliers—some of them left over from the days when Atari was owned by Warner Communications—who say they aren't getting paid.

In addition, the ST's complexity and price force Atari into the specialty stores, because mass-marketing discounters such as K mart and Toys R' Us, which carried the cheaper Atari game computers, don't like to carry such expensive merchandise. One rumored solution would be to provide a stripped-down version to discounters, with enhanced versions for computer dealers. (In fact, Atari, which had withdrawn from exhibiting at the CES this year, claiming that it wanted to focus on selling into computer specialty stores, recently asked to get back in.)



Who needs it? Tandy chairman John Roach is skeptical about computers now being designed that connect to wiring as an integral part of the smart-home concept.

Tramiel isn't the only one with a hard way to go. The home computer market in Japan consumed 1.1 million machines last year and is growing modestly in 1985, but it remains essentially a game market. High-sounding phrases of the future, such as budget accounting, remote office work, and videotex services, are still talk and not yet reality.

"There is no home computer market in Japan, in the real sense of the term," admits Ekoh Yoshida, a marketing executive with the ASCII Corp. of Tokyo, a subsidiary of Microsoft Corp. He claims the market that uses computers for games as well as education, videotex, and controlling other home electronics functions will take "another two to three years to develop."

An old story. Says analyst Yeo Eul Yoon of Jardine Fleming (Securities) Ltd.'s Tokyo office, "The problem is finding what the consumer needs are. The only need that has emerged so far with a product to match it is the game market. As for all the other potential uses—home banking, home shopping—I doubt seriously if those fit the lifestyles of Japanese housewives. One of their main pastimes and pleasures is going outside the home to shop. They don't want to stay home to do such things."

The two largest producers of home computers in Japan—NEC Corp., which claims a 40% market share, and Sharp Corp., which claims 20%—do not use the MSX (Microsoft Extended Basic) system that Microsoft Corp. developed and has licensed to 18 other Japanese companies. Total MSX sales last year are estimated at 350,000 units. But NEC's best-selling 8801-MII is used mostly by university students and small businesses for bookkeeping or document filing; MSX users are overwhelmingly 15 years of age or younger—game fanatics.

ASCII recently announced an enhanced version of its MSX-2 computer with interface capabilities for videotex and other electronic media, but in its announcement the company said early demand will be in the office, not the home. No wonder: prices of the new models will range from $400 to $800. MSX companies are said to be planning their first exports this summer. "We haven't decided yet. And in the case of the U.S., we haven't even decided which end of the market to enter," says a Japanese electronics industry executive.

Says analyst Darrel E. Whitten of Prudential-Bache (Japan) Research Ltd., "If they do enter the U.S. market, they'll have their heads handed to them on a platter. It's much too competitive for the Japanese game products, which do not have outstanding graphics."

Infocorp's Lewis disagrees, citing examples of MSX machines in the classroom, interfaced with "audio-video little gadgets" the way they are in Japan. "In education, you could interface them with laser disks and conduct a chemistry experiment right on the screen. If you use the wrong chemicals, an explosion would show on the screen. That is a wonderful concept to bring into the education market." ☐

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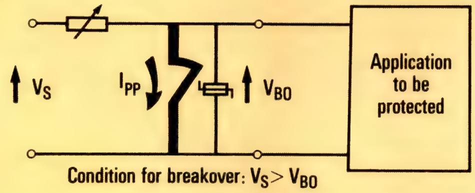

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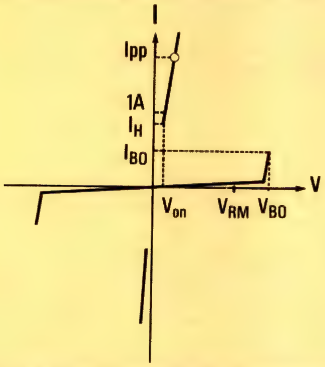

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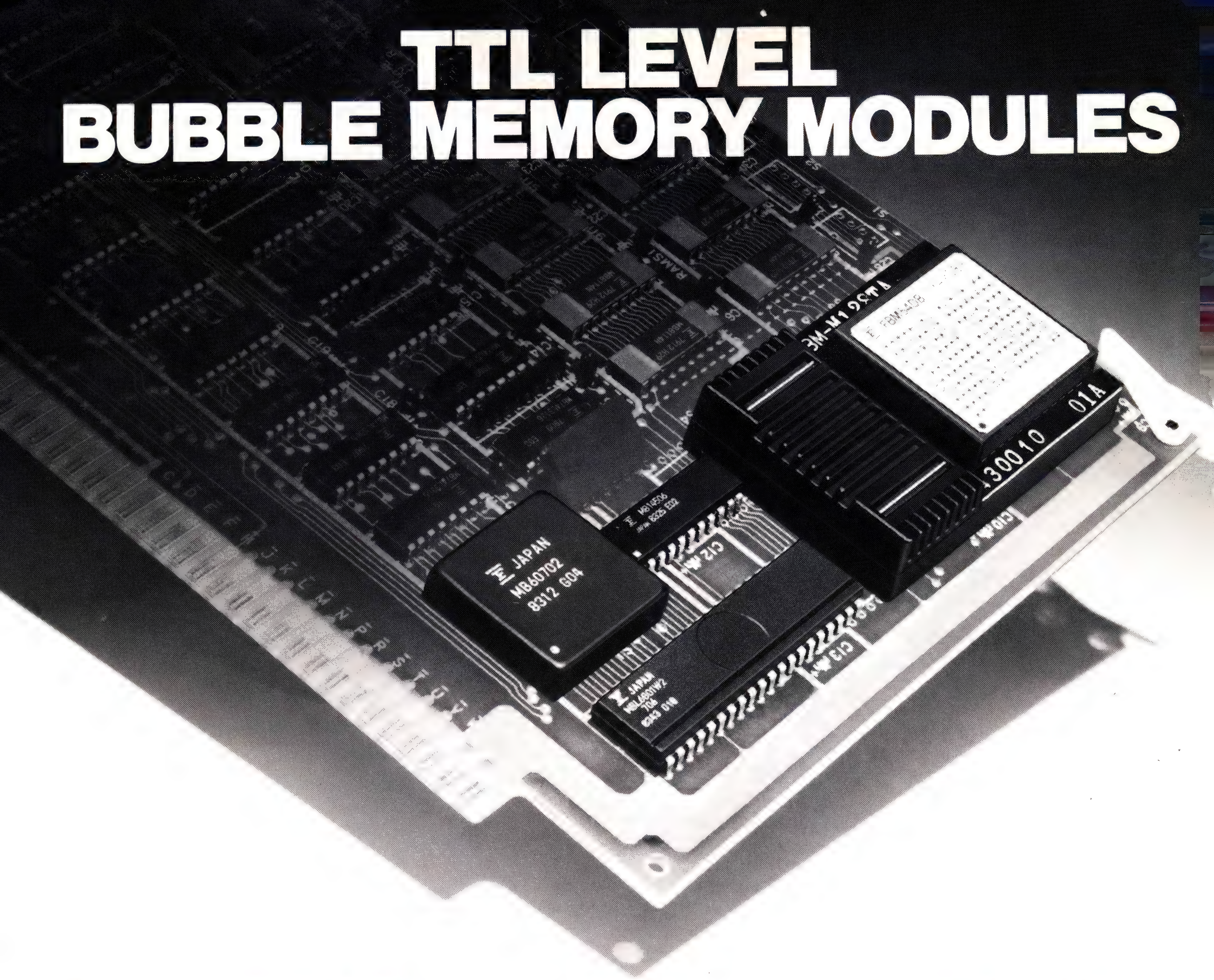
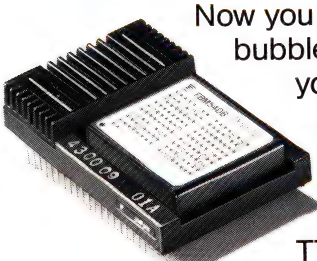
TTL LEVEL BUBBLE MEMORY MODULES



Fujitsu's BMM Series bubble memory modules let you design your own board.



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Interface	TTL level	
Transfer rate	100K bit/s	
Access time	11.2ms	
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Storage temp.	−40 to 85°C	−30 to 75°C
Weight	75g	
Dimensions	43.5 x 65.5 x 13.7mm	

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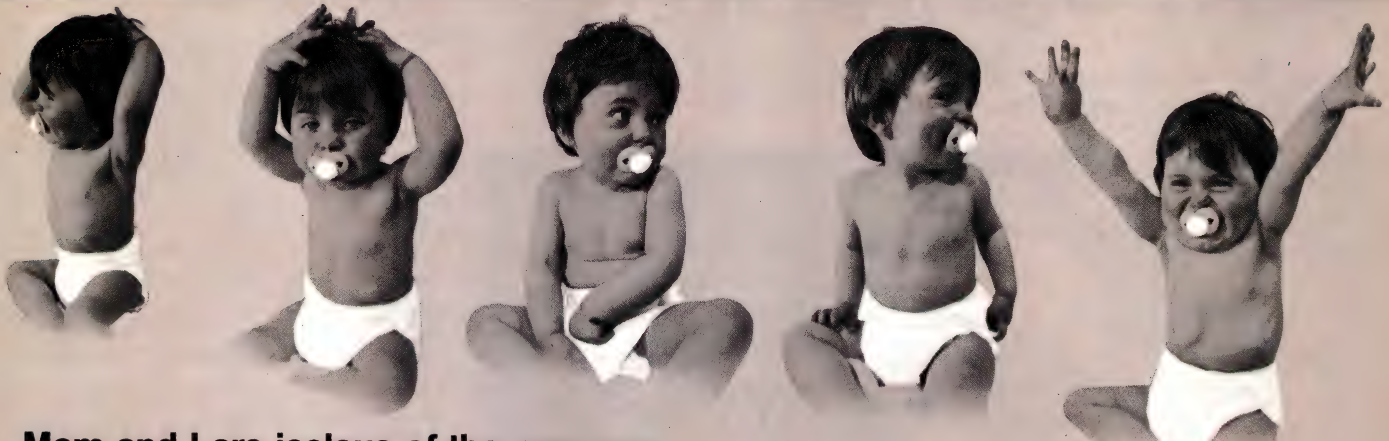

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SOUTH KOREAN IC MAKER SEEKS WORLD MARKETS

Gold Star Semiconductor thinks its late entry into electronic components will prove beneficial in the long term

Big plans. Gold Star Semiconductor invested more than $250 million in facilities and technology transfer last year alone, but the payoff could be sales close to $200 million this year.

Seoul

A company that didn't even exist a decade ago is bidding to become the first non-Japanese electronic-component maker in Asia to crash the world market in a big way. The cost of this push has been staggering—more than $250 million in facilities and technology transfer last year alone—but Gold Star Semiconductor Co., the electronics arm of one of South Korea's major conglomerates, believes its late entry into high technology will have a major payoff.

"We're going to advance more in the next three years than we have in the last 10," says P. June Min, the effusive senior managing director of Gold Star Semiconductor, who predicts 1985 sales will be "close to $200 million."

Early this year, the parent Lucky Gold Star Group, which includes separate corporate entities in fiber optics, consumer electronics, telecommunications, and electrical equipment, opened a $110 million joint research and development center at Anyang, a suburb of Seoul. Inside this complex, the company has gathered an impressive group of engineers, most of them U.S.-educated and with experience at major U.S. electronics companies.

"We've got the talent," says Min, who has a doctorate in computer science from Purdue University as well as more than a decade of experience at IBM Corp. "And by selecting the partners we have, we're in a long-range position to play a major role in the world market."

Two years ago, almost 90% of the company's sales were in telecommunications products, most of them for in-house products or a major Gold Star partner, AT&T Co. This year the ratio will drop to 70%, and Min predicts a 50-50 balance between telecommunications and chips by 1987.

The Gold Star strategy includes technology and marketing tie-ups with AT&T, Siemens, and Olivetti for telecommunications and computer products; with Advanced Micro Devices Inc. for memory products; with Zilog Inc. for microprocessors; and with LSI Logic Corp. for gate arrays.

The most recent move is an agreement for manufacturing and limited marketing rights (in Asia only) for AMD's coming line of 256-K dynamic random-access memory products. "We hope to ship samples by this summer, with mass production by early 1986," Min says. Gold Star is already manufacturing an estimated 700,000 64-K DRAM chips per month for AMD under a deal signed last year.

A pending deal with Fairchild Camera & Instrument Corp. to manufacture 64-K CMOS static RAM products will result in another investment of nearly $100 million in a line at Gold Star Semiconductor's production complex in Gumi, 250 miles south of Seoul.

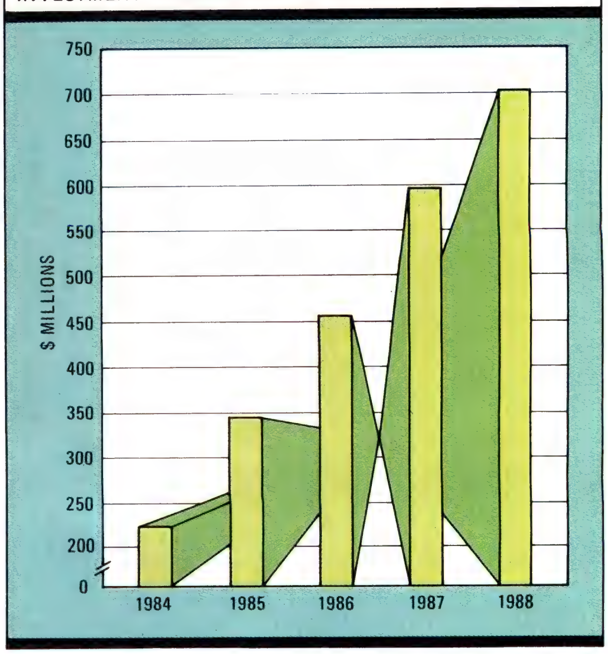
The 1984-85 semiconductor market slump has made Min cautious about predicting when Gold Star will turn the corner, but he's very definite on one point: "We're connected now with high-demand products which are not as severely affected by slumps."

High-growth area. The AMD 256-K line is very advanced in terms of design rules and processes, with average access times of 100 ns, he says, and by entering the 64-K SRAM market, Gold Star is positioning itself in a segment that recent market estimates predict will grow to 30% of the total memory market by 1988.

In the semicustom field, Gold Star has two licensing agreements with LSI Logic to manufacture, package, and sell the U.S. company's 3000, 5000, and 7000 gate-array series, which range from 272 to 10,000 gates. More than 75% of the sales will be "buy backs" by LSI Logic; for the near term, there are only marginal profits for Gold Star. Still, the company has increased its range of production capabilities in the process.

The Gold Star-Zilog link was a straight technology-transfer deal giving the Korean firm rights to manufacture

INVESTMENT TO SOAR FOR S. KOREAN CHIP FIRMS



and market the Z80 microprocessor. The moves also are part of a diversification strategy designed to shield Gold Star from the drastic fluctuations of the memory-market cycles of recent years.

"At present, we have strong in-house demand for all our products from our growing sister companies. Gold Star Electronics is building 7 million color TV sets this year, and the telecommunications company will produce half a million telephone sets, as well as CRT terminals for computers. But in any case, our goal is to limit memory to no more than 30% of total production," says Min.

Long-term trouble? Though Gold Star hasn't made the short-term mistake of overemphasizing mass-memory products, it may have trouble in the long run competing with Japanese makers in the semicustom integrated-circuit business, says senior analyst Jin Ho Chung of Prudential-Bache, Far East Research Ltd. "I think Samsung Electronics and Gold Star will emerge as the dominant Korean component makers, but Samsung's larger investments in production may pay off in two to three years because their scale of operation will allow them to be price-competitive," says Chung.

"Gold Star has diversified smartly, but the parent company's decision several years ago to enter heavy industry as well curtailed investments in Gold Star Semiconductor. That may damage their near-to-midterm growth."

Still, the ultimate goal lies overseas. Although his U.S. export figures at present are mostly consignment work, Min expects Gold Star to emerge as a major supplier for his U.S. partners.

"We don't care how our products sell, as long as they sell. Already our yield in memory devices is close to 50% and for some telecommunications devices it's better than AT&T can manage. And of course we have lower labor costs," he says. The lone U.S.-based part of the operation is United Microtek Inc., a software subsidiary based in Sunnyvale, Calif., that is charged with developing custom software for products destined for the U.S. market.

Gold Star is now doing much of its selling in Asia, including some unexpected locations. "We have a two-year, $10 million contract with a provincial government in the People's Republic of China for the sale of TTL devices," Min says. "If they actually use all the TV-set manufacturing equipment they're buying, they'll be in the market for a lot of devices in the next few years."

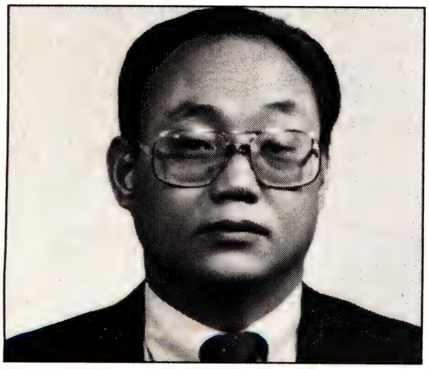
The deal is part of a burgeoning trade relationship between two ideological opposites, South Korea and China. The two countries do not have formal diplomatic relations, but they will transact more than $400 million in various deals this year. "We sell to them through our office in Hong Kong, just as most Korean firms do," Min says.

The U.S.-trained executive even sees prospects in Japan, where Gold Star companies are already marketing such consumer products as microwave ovens, refrigerators, and color TV sets—with electronic components supplied by Min's semiconductor operation.

Japan's demand strong. Japanese demand for arcade-game products remains strong, boosting the need for 8-bit microprocessors. And because Gold Star's export limitation agreement with Zilog expires this month, Min is trying to market the Z80 through Japanese trading companies. He also has plans to market AMD's 256-K products in Japan.

In time—"within three to five years"—Min believes that the full impact of the South Korean investments will be paying off. "The trend is clear," he says. "U.S. and European makers are moving to offshore production, and we believe that our manufacturing capability and cost effectiveness soon will compete with anyone." *–Michael Berger*

Progress. "We're going to advance more in the next three years than we have in the last 10," says Gold Star's P. June Min.



S. KOREA'S CHIP INDUSTRY WILL OUTPERFORM THE WORLD MARKET

	1984	1985	1986	1987	1988
	$ millions				
Total production	25,760	32,860	37,280	41,150	49,990
South Korean production	205	403	655	923	1,250
Percentage of total	0.8%	1.2%	1.8%	2.2%	2.5%

SOURCES: DATAQUEST INC., GOLD STAR SEMICONDUCTOR

BOTTOM LINES

IBM PC sales fell in first quarter
Quantifying what many observers already suspected, market-research firm Future Computing Inc. says that sales of IBM Corp.'s Personal Computers dropped throughout the first quarter. According to the company's study, sales of all IBM PCs—including PC/XTs and PC ATs—averaged 53.6 units per store in January; 46.7 units per store in February; and 41.9 units per store in March. In December 1984, retailers surveyed by the market-research firm reported selling an average of almost 100 units per store. Analyzing sales at retail stores, Future Computing estimates that 20% of annual sales take place in the first quarter of the year; 22% occur in the second quarter; 23% in the third quarter; and 35% in the fourth quarter.

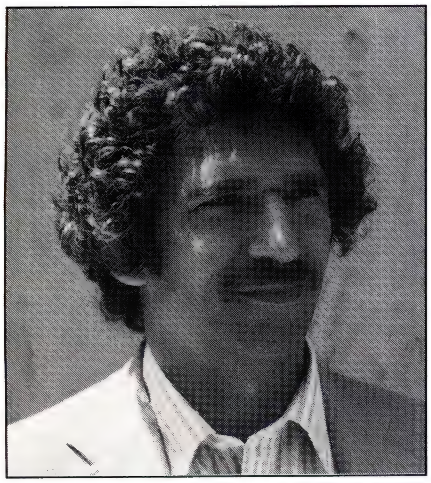
Micro Mask buys test company
Micro Mask Inc., Sunnyvale, Calif., has acquired Probe Technology Corp., of Santa Clara, Calif., for $1.4 million. According to Micro Mask, Probe Technology makes and sells probe cards and related products used to test integrated and hybrid circuits for the semiconductor industry.

Communications company gets cash
Network Switching Systems Inc., a developer of wide-area networking products in Andover, Mass., received $9.3 million through a second round of venture financing. Among the investors was Infotron Systems Corp., a Cherry Hill, N.J., data-communications-equipment supplier. Network Switching Systems said it has entered into a joint marketing agreement with Infotron, under which Infotron will offer Network Switching Systems' products.

New venture-capital guide released
Venture Economics Inc., the Wellesley Hills, Mass., producer of *Venture Capital Journal*, a monthly analysis of venture investment activity, has published the ninth edition of *Pratt's Guide to Venture Capital Sources.* The company says the guide, which costs $95, contains over 600 pages of data on the venture-capital industry, including a directory of more than 700 active U.S. and Canadian venture-capital firms.

Visual systems firm gets funding
Visage Inc., a Natick, Mass., maker of visual information systems, raised $3 million in a second round of venture financing. According to Visage, its products include a family of interactive laser video-disk systems. The company said it will use the proceeds of the financing to fund existing operations and to continue its research and development activities.

PODELL HELPS GaAs TO COME OF AGE



In growing demand. Allen Podell of Pacific Monolithics sees gallium arsenide microwave integrated circuits coming of age.

Sunnyvale, Calif.

Allen Podell started designing early. Now president and chief executive officer of Pacific Monolithics Inc. and one of the most prolific designers of monolithic microwave integrated circuits, Podell built his first radio at the age of 12. He was primary designer of a dozen microwave ICs for such companies as Honeywell, Hewlett-Packard, General Electric, Hughes Aircraft, and Varian Associates.

Podell, a 25-year veteran of microwave-circuitry design, worked with gallium arsenide pioneer Charles Liechti in 1974 at Hewlett-Packard Co. Last year, after starting two consulting firms, he founded Pacific Monolithics. For Podell, consulting was "a stepping-stone to running a manufacturing operation."

Price is right. His consulting experience helped Podell decide to focus on microwave circuits rather than the more common MOS and bipolar technologies. "I became aware that what really counted was doing the job for a price," he says, and adds that his company can produce GaAs chips, which are usually expensive, cheaply because his designs cram much more functionality into the same chip real estate. "We discovered that the smaller the design could be with good performance, the less expensive the GaAs would be and the sooner it would have a practical use," he says.

Podell foresees GaAs "coming of age," and several foundries are willing to fabricate GaAs circuits to Pacific Monolithics' specifications with guaranteed yields, which also improves price performance. "A fantastically clever design doesn't matter. If it costs too much, no one will buy it," he declares. "You always have to beat a current, cheaper technology."

With this goal, the company introduced its first product, a low-noise-block downconverter called the LNB, at a satellite-TV trade show in Las Vegas last March 31. Designed by co-worker Bill Nelson and Podell, the GaAs chip—which measures a minuscule 1 mm on a side—is a complete receiver front end for satellite TV communications. It operates in the 3.7- to 4.2-GHz range and contains a local oscillator, a doubly balanced mixer, a radio-frequency preamplifier and an intermediate-frequency preamplifier. With slight modification, the local oscillator can serve as a buffer amplifier for an external local oscillator. The chip can also be used as a universal i-f converter.

Podell says most companies can fit only a two-stage amplifier in the same amount of space. One customer, Hytek Amplifier Inc. of Joplin, Mo., is buying the chip, renaming it the Super B, and selling it to a growing satellite TV distribution network.

Pacific Monolithics expects to produce 10,000 LNBs each month for less than the cost of a standard low-noise amplifier. *–Denise Caruso*

BONFIELD, WILMOT FORM STRONG TEAM AT HELM OF ICL

London

Although Peter Bonfield took the helm from his long-time colleague Robb Wilmot as managing director of International Computers Ltd. plc last September, the partnership between the two continues as strong as ever. Bonfield's appointment was in the wake of a merger between Britain's flagship computer company and Standard Telephones & Cables plc, a British telecommunications-gear manufacturer. Sir Kenneth Corfield, STC's far-seeing chairman, masterminded the takeover in a bid to create a group that can exploit the convergence between telecommunications and data processing. In the ensuing reorganization, Wilmot was appointed chairman of ICL and became a director of STC with a mission to plan the long-term strategy of the merged group. Meanwhile, the 40-year-old Bonfield took on the daily running of ICL.

Last month, Bonfield presided over the launch of ICL's new 3900 mainframes, designed with the help of Fujitsu Ltd.'s chip technology [*ElectronicsWeek*, May 6, 1985, p. 24]. The success of the new line is crucial to ICL's recovery. But this time around, Bonfield was down-playing the technology. Virtual Machine Environment, ICL's proprietary operating system, "is the bedrock of our strategy," he says.

This approach would appear to make ICL a loner in an IBM-dominated world. But the London company is banking on AT&T Bell Laboratories' Unix, which it will host under VME, as an alternative to IBM's proprietary operating system, and is collaborating with other European computer makers to develop tools for writing Unix software. "We may enter the U.S. [market] in a year or two, when we can run Unix," he says.

Team play. The Bonfield and Wilmot team runs on its own operating system. "We do not need to spend much time together," remarks Bonfield of the strong relationship between himself and Wilmot. "We communicate over hyperchannel." Often, they keep in touch by car phone during the morning commute. "We are very effective together. It is almost telepathy," says Wilmot.

Bonfield, who was marketing director of ICL's World Wide Operations division from 1981 to 1984, played a key role in slimming down and streamlining ICL's worldwide marketing operation and in forging close links with British software houses. "ICL is a very different company [from what] it was four years ago," he says. "We have become market- rather than technology-led."

Bonfield reorganized ICL's marketing operations to focus on five industry sectors—retailing, manufacturing, public administration, defense, and financial services—each supported by its own business center.

He says ICL's new One Per Desk executive work station was developed by a small team with marketing, sales, and design under one roof. *–Kevin Smith*

Motivator. Peter Bonfield, who has a workaholic, go-getter reputation, took on the daily running of ICL last September.

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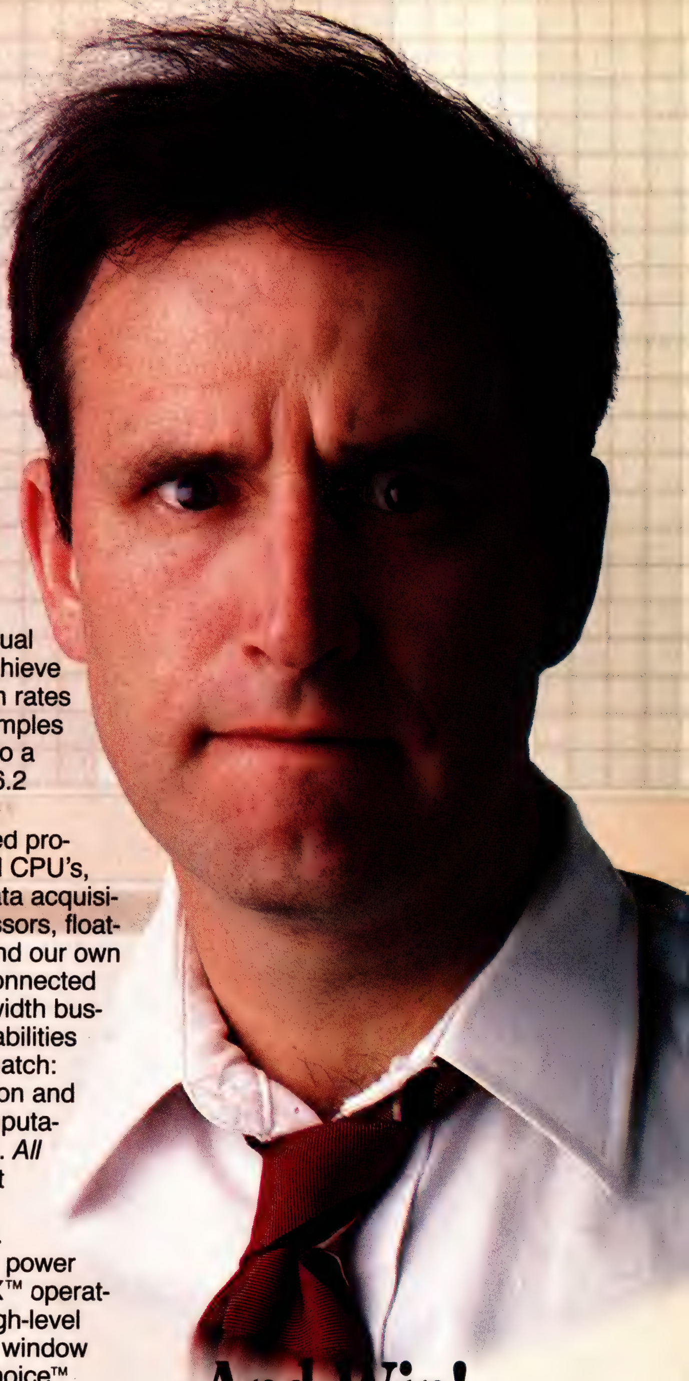

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ENDING FOURTH DECADE, CHIP MAKERS FACE DOUBT AND UPHEAVAL

by J. Robert Lineback

UNCERTAIN OF ITS NEXT BIG PAYOFF, THE U.S. SEMICONDUCTOR INDUSTRY IS PINNING ITS HOPES ON THE REDESIGN ERA

Since the birth of the solid-state business nearly 40 years ago, semiconductor merchants have made overnight fortunes and lived a boom-and-bust life that defied the supply-and-demand rules governing nearly all other industries. But having reached middle age, the industry finds itself at best confused and at worst riddled with doubt about its coming years.

Like any near-40-year-old, it is looking back on its past and wondering what the future holds. The uncertainty is not so much about its survival as it is about its future direction: the sheer steepness of the market's fall, the rise of global competition, and the sudden collapse of a promising, young personal computer market are the seeds of the semiconductor industry's mid-life crisis.

Though dismissed by some as the gloom that accompanies all downturns, misgivings center on whether or not the price elasticity of silicon circuits is strong enough to jounce the capacity-laden industry across projected revenue levels for 1990. The climbing costs of leading-edge technology plus weakened returns from the mid-1980s slump is now expected to touch off the harshest shakeout in the industry's history. The results are expected to be a string of mergers, acquisitions at bargain prices, and many failures.

"We have more excess capacity coming on stream at the worst possible time, causing continued pricing pressures. For all intents and purposes, the industry is at break-even point—and many companies are, of course, losing money," says analyst Michael J. Krasko of L.F. Rothschild Unterberg Towbin in New York. "From here on, the industry will become substantially more leveraged. Chip firms will be going to the banks to finance capital-equipment spending, inventories, and research and development programs. If demand does not pick up soon—6 to 12 months—more pressure will be placed on the financial structures. That's a real concern," he warns, explaining the pessimism of investor circles.

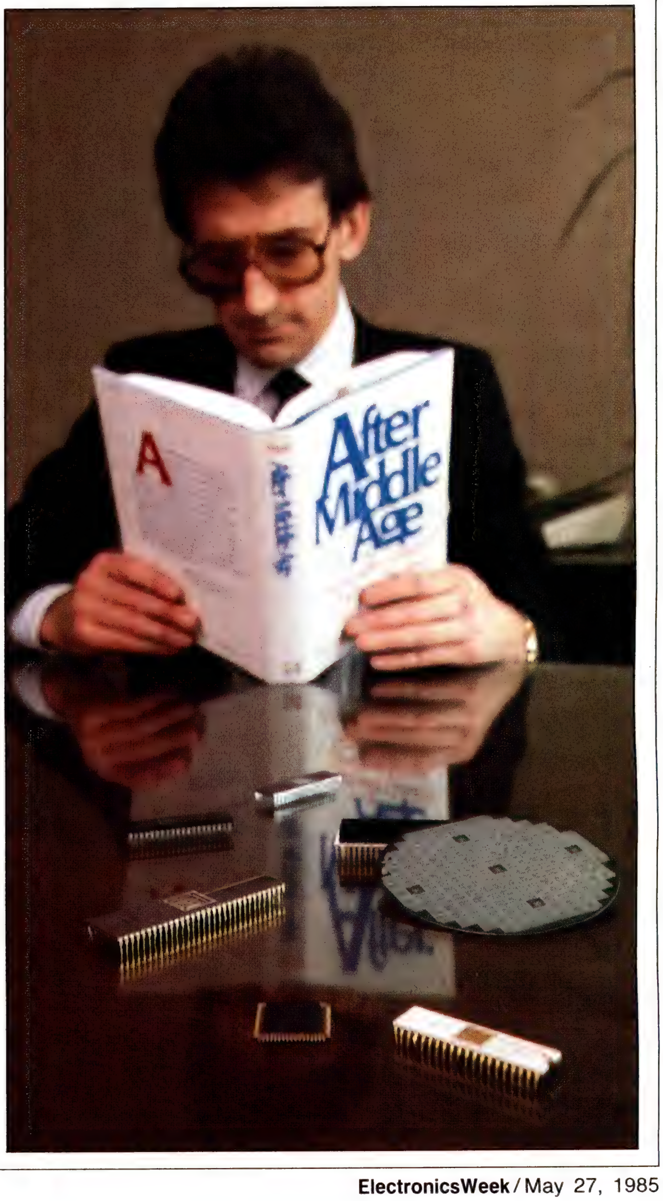
"What happens historically is big chunks of growth have always come from new emerging equipment markets," notes Timothy Propeck, marketing vice president at Monolithic Memories Inc. in Sunnyvale, Calif. "Mainframe computers were an emerging market for semiconductor memories first, and then in the 1970s it moved on down to the minicomputer, which was not only significant for random-access memories but other silicon products. Then the personal computer, which also had the microprocessor.

"You will continue to see growth dependent upon new markets, but sitting here I cannot predict what it will be. And that is what makes people uncomfortable today," he adds.

Most forecasts place worldwide chip sales at less than $25 billion in the current down year. By the end of the decade, the total is expected to surge to $60 billion—or even beyond $70 billion, by some estimates.

Therein lies the heart of the confusion: despite such glowing predictions, many companies have begun to throttle back, laying off thousands of workers and idling expensive production equipment while jittery analysts warn that sliding revenues and profits are jeopardizing many U.S. producers by seriously eroding the capital-raising leverage essential to staying competitive.

Nevertheless, semiconductor managers and executives are still banking on an eventual recovery, believing history repeats itself and that the nature of the chip business is to bounce back with much higher sales after a stiff downturn.



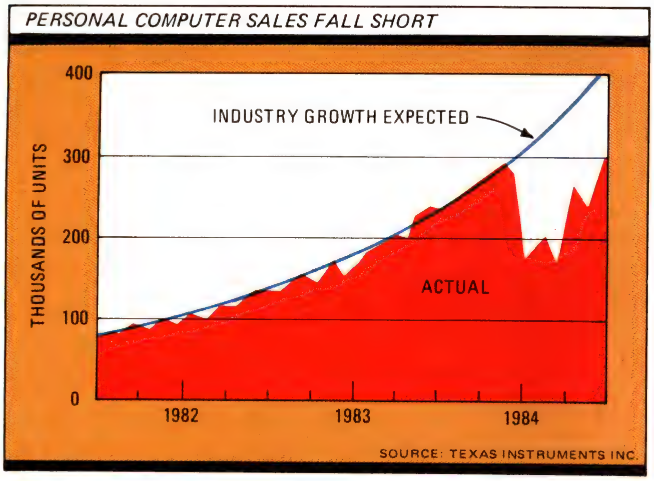
But it appears the fundamental direction of the industry will change forever.

This year's quagmire of soft demand, cheap integrated circuits, marked-down RAMs, and an explosion of do-it-yourself semicustom components is inspiring what some chip veterans say is a major "redesign revolution." For some silicon houses, the last half of the 1980s promises new sources of chip consumption based on full-scale redesign of familiar end-user equipment, such as telephones, TV, home appliances, power supplies, military equipment, medical systems, transportation electronics, office lighting, and, yes, even the not-so-very-old personal computer.

The era of redesign is a focal point of a new market scenario from Texas Instruments Inc., which is forecasting growth in merchant chip shipments from $22 billion in 1985 to $70 billion in 1990—about 10% of the total electronics industry. TI president J. Fred Bucy believes the electronics industry has reached the point at which many major end-equipment markets are now ripe for performance upgrades and size-reductions based on new large-scale-integration technology.

"The things that new technology is going into include the automobile market, miniaturization of video cassette recorders, and the new capabilities coming for TV—the high-resolution TV and so forth," Bucy said last month while fielding analysts' questions in Dallas. Bucy expects new markets to emerge eventually. But, like many others, he admits new volume equipment markets are not yet in sight, causing TI to bet on a major systems redesign movement in the second half of the decade.

PERSONAL COMPUTER SALES FALL SHORT



SOURCE: TEXAS INSTRUMENTS INC.

Proponents of a redesign era say most redesigns of the late 1980s will be fueled by application-specific components, in much the same way that microprocessors triggered explosive new growth five years ago. For chip suppliers, semicustom and application-specific very large-scale chips will provide a haven against aggressive pricing competition of overbuilt commodity memories and logic. The migration from bipolar and n-MOS technologies to low-power CMOS is also expected to fuel the redesign movement.

Waiting for hints

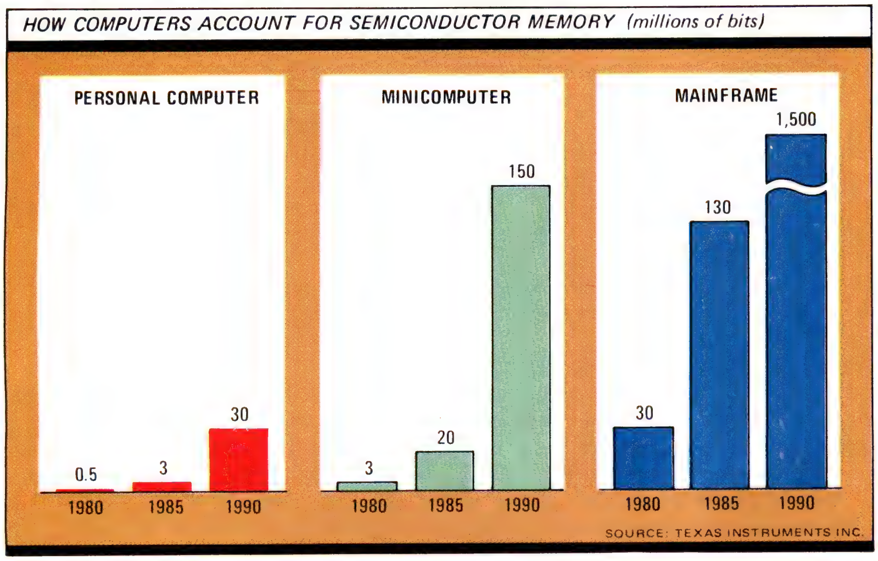
But many executives disagree, believing semicustom, higher-scale integration, and CMOS will soon ignite growth along a more historical route. The late-1980s rebound, they counter, will more likely result from new, suddenly emerging volume markets. Early in the 1980s, personal computers played the role of new-growth reviver, only to fade almost as quickly last year. Eagerly looking for a new one to take its place, many chip vendors are waiting for the slightest hint of a new end-equipment boom.

Favored targets include a wide-open field of voice and data communications applications, lap-type portable computers, electronic funds transfer, direct-broadcast satellite, personal mobile phones, white-collar robotics, artificial intelligence, and sophisticated controls for the home. Brewing new market segments, such as improved computer graphics, cheaper engineering work stations, local-area networking, and digital switching for telecommunications, are also strong candidates for much larger growth in the immediate years.

Sources for huge jumps in silicon consumption can come from rather untraditional sources. While vendors are looking for ways of turning new circuits into new revenue, smart-credit-card companies hope soon to slip a few microcomputers into the billfolds of millions of consumers. With several critical tests slated this summer in the U.S., smart-card executives believe the business could mean that 800 million microcomput-

Ripe for upgrade. Texas Instruments' president J. Fred Bucy (right), with TI's chairman Mark Shepard, told a group of analysts recently that the semiconductor business is entering an era of redesign, and user equipment is ripe for upgrades and size reductions.

HOW COMPUTERS ACCOUNT FOR SEMICONDUCTOR MEMORY (millions of bits)



SOURCE: TEXAS INSTRUMENTS INC.

er chips alone would be mounted on plastic for charge-account transactions and electronic funds transfer.

"Then you have all the terminal equipment as well, which carries on a dialogue with the chip inside the smart card," says Paul B. Wittfeld, vice president at Micro Card Technologies Inc. in Dallas, which has slated a summer field trial with Mastercard in Washington. "I think the world's eyes are on this one," Wittfeld says. "If it goes as we think, I would say late next year you could see the beginning of large-scale implementation." Micro Card's smart credit card uses a Motorola 6805 8-bit microcomputer.

Communications DRAMs

The rapidly evolving market for digital telecommunications is likely to affect the demand picture as well. This is especially true for dynamic RAMs, according to Patrick Brooks, product marketing manager at Intel Corp. Brooks says large central branch exchanges are consuming more DRAMs than some mainframes—upward of 64 megawords, with each word 64 bits wide.

Further out in the digital voice/data network will be systems acting as nodes on the telecommmucations links, which Brooks says will require new high-speed memory features for such applications as optical character readers, laser printers, and digital signal processing.

"In digital signal processing, you will have voice recognition and pattern recognition. All of those require high throughput of large amounts of information and could really take advantage of new features," he says.

Nevertheless, the capital costs of producing memory bits by means of increased densities and tighter design rules continues to promise a downward trend for at least the next two DRAM generations despite rocketing fabrication costs, believes Donald W. Brooks, president of Fairchild Camera & Instrument Corp.'s North American Semiconductor Division.

TABLE 1: DENSITY OUTPACES WAFER COST

	Feature size (μm)	Bits per chip	Die size (mil^2)	Bits per mil^2	Cost per 5-in. wafer ($)
1984	2	256 K	60,000	4.3	7.60
1986	1	1 M	70,000	14	10
1990	½	4 M	80,000	51	14
1995	¼	16 M	100,000	164	50 to 60

SOURCE: FAIRCHILD CAMERA & INSTRUMENT CORP.

Assuming the use of a 5-in. slice, a 2-μm 256-K chip cost $7.60 per wafer in 1984, compared with a projected cost of $14 per wafer for 0.5-μm 4-Mb DRAMs in 1990. The cost per electronic function will still improve by 40 to 1 Based on today's information, however, the cost per wafer of 16-Mb chips rises dramatically because of the need to use X-ray or electron-beam direct writing for 0.25-μm geometries.

Dual-ported memories, which are now being aimed mostly at high-resolution computer graphics, can be used in electronic-mailbox routing applications to ease bidirectional communications across two asynchronous buses. Extra on-chip logic, address-decoding schemes, and such features as multiports with shift registers will tailor RAMs to specific applications in the future.

In addition to application-targeted memories, application-specific logic circuits—including semicustom gate arrays, standard cells, and tightly tailored processor chips—top nearly all lists as the most likely to succeed in the late 1980s. Integrated power semiconductors with on-board logic, new custom components for automotive systems, and monolithic linear chips are also sure bets in the redesign movement.

"I share a little concern about the fundamental growth only from the standpoint that it is not obvious what the next major electronics product is going to be—that being what will drag total consumption up again," admits Fairchild's Brooks, who echoes the feelings of most chip leaders.

"But my confidence is driven by a couple of things," he adds. "One is a massive fanout of electronics to new world markets, such as the developing nations. And then there is the fact that memory prices drive new markets, pulling along with it linear, logic, and other components."

Design activity has actually increased during the current slump, asserts William E. Nicholson Jr., senior vice president at the American Microsystems Inc. subsidiary of Gould Inc. in Santa Clara, Calif.

"This is because things are not selling and our customers need to get new features and new designs in place," he explains. "What we have found is startup design activity is stronger than ever in our history in gate arrays and standard cells. This is good, because I predict we'll see fairly quickly the next generation of equipment across all markets."

No hula hoops

Whatever the source for new growth, few are counting on the fickle consumer markets to lead the way after the total collapse of interest in the early home computers and video games. "It's not going to be the 'hula-hoop' product creations," says Joe Van Poppelen, vice president of marketing at National Semiconductor Corp. "Productivity demands in the office, factory, and in the homes of the white-collar workforce will be the driving force behind any new emerging equipment markets," he predicts.

At RCA Corp.'s Solid State Division, Herbert V. Criscito, vice president of marketing, believes the sudden collapse of the personal computer market has temporarily clouded the industry's view of the coming years and new end-equipment markets. RCA, looking for the industry to snap out of its tailspin and reach $34 billion in 1987, believes most of the growth will come from new CMOS products.

The low-power technology is growing at a rate of 35% to 36%, Criscito estimates. RCA, as well as its competitors, plans to launch later this year the next generation of advanced high-speed CMOS logic, which will have the same perfor-

Fanout. Despite his concern that the next large market for semiconductors has yet to appear, Fairchild Camera & Instrument's Donald W. Brooks believes a continuing fanout of electronics products to new markets and applications will spell business as usual.

mance but lower power as advanced low-power bipolar Schottky logic.

To Ed Ross, vice president of linear, LSI, and MOS at Signetics Corp., the industry has had a tough time lately anticipating markets. "We are not in a good position of second-guessing our customers," he says, referring to overblown projections of personal computer sales. "In 20/20 hindsight you can look back and say we should have been more intelligent."

The industry's inability to identify new emerging markets is not a totally new situation, believes Clive Ghest, vice president of product planning at Advanced Micro Devices Inc. "We certainly could not have predicted the personal computer boom 10 years ago—or even the video-game boom, for that matter," Ghest states. "It is, therefore, rational to believe as we increase the integration levels with more value and intelligence on chip, there will be new markets that are hard for us to see. The new markets stop suddenly emerging when the technology matures, and we are nowhere near that."

With severe pricing pressures in worldwide commodity chip segments, National's Van Poppelen believes U.S. companies will hone their efforts more and more on VLSI chips that perform dedicated tasks at much lower costs and higher speeds. "Today, less than 20% of the IC business is VLSI. In five years we are looking for it to be 45%," he says.

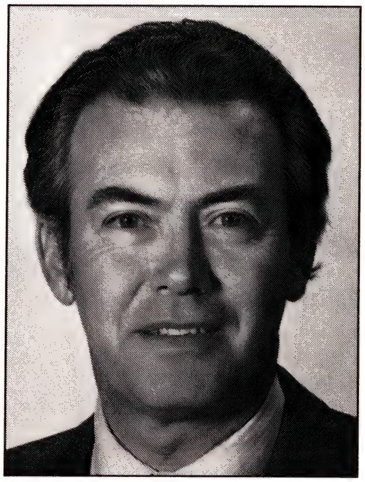
"That changes the whole nature of the industry and, more importantly, the relationships between vendor and customer. It preempts the commodity nature of the business," Van Poppelen says. An example of such an application-targeted VLSI chip is National's recently introduced data disk separator, which can handle tapes as well as hard, floppy, and optical laser disks. "As you do this, the semiconductor firms become the development staff for major system building blocks, and that requires a much closer partnership with the customer," he adds.

Therefore, the source of sudden chip demand is expected to leave an imprint on future IC technologies and guide chip product directions for the early 1990s. Such has been the case in the first half of the 1980s, with the personal computer explosion giving birth to the new generations of by-4- and by-8-bit DRAMs.

Hope for application-specific ICs

Motorola Inc.'s Doug Powell, director of strategic marketing for the Semiconductor Products Sector, believes market dynamics will continue a historical trend with low cost triggering new end-equipment niches. Besides lower memory prices, Powell believes that semicustom logic will drive a round of systems designs in the last half of the decade. As use of application-specific ICs grows, it will take away business from standard logic components, such as TTL, low-power Schottky, and advanced LS, he says.

"The growth in application-specific markets will be very high, but you are losing out on the standard logic side. The net growth [for the total semiconductor industry] does not add up to that much," Powell notes.



Nothing new. According to Clive Ghest, vice president of product planning at AMD, the inability to see new markets in advance is nothing new.

Still, application-specific ICs are expected to be an influential player in the communication markets, which are likely to explode in the latter half of the decade, notes Steve Painsky, Motorola's manager of strategic marketing for market segments. "Application-specific ICs are well-suited for these product concepts as they evolve, and once a product has been out and successful, designers can further integrate functions to make them more cost-effective," Painsky adds.

With the spread of more powerful design tools and emerging interface standards for engineering work stations, semicustom chips are now starting to find more homes in systems, gobbling up business once served by medium-scale and small-scale logic. The net result is often actually a loss in industry revenue, note many observers.

In personal computers, redesigns are almost always initiated to reduce costs, says industry analyst David Wilson at Future Computing Inc. "We are projecting a growth in business personal computers of over three times between now and 1990, but the semiconductor revenue growth from that market will not increase at that same rate, partly due to redesigns to get out costs," he says. RCA's Criscito agrees, citing semicustom projects under way to reduce the 200 chips it takes to produce an IBM Corp. Personal Computer AT to about 20 ICs.

The semicustom redesign movement is having an impact on the analog world as well. "I think you are going to see analog getting a new lease on life and coming back in the electronics world," says David J. Guzeman, vice president of marketing and sales at Zymos Corp. in Sunnyvale. "For a while, the industry was able to make digital transistors so cheap that everyone converted nearly everything to digital, but you are going to see analog stage a comeback and live happily on the same chip as other, digital components. That will lead to some real interesting uses," he adds.

One new potential volume application involving Zymos application-specific ICs is an experimental project for Consolidated Edison Co. of New York Inc. that allows the power company to read electric meters remotely. Some field trials are being conducted on the East Coast. "One thing going on is that the cost of building new power stations is getting so high and takes so long, that the industry is forecasting power shortages across the nation," says Guzeman. "If the power company can communicate with your appliances and shut them off for a few minutes, they might not need to build new power-generating stations for peak load periods."

A shot in the arm

Analog Devices Inc. of Norwood, Mass., expects linear design to get a shot in the arm from a new analog signal processor that replaces a 3-by-3-in. module with a single chip. To slash costs 10 times, the soon-to-be-announced bipolar analog signal processor is expected to open up several new applications with lower costs and higher speeds.

A number of chip houses are also eagerly anticipating new design activity in the power semiconductor arena with greater availability of intelligent integrated MOS FETs. The integrated power ICs are replacing harder-to-use bipolar discretes. "I think the big portion of the growth will come from existing applications, whether it's making cars smarter or more efficient or industrial controls and robots," says Derrick Lidow, vice president of International Rectifier Corp. in El Segundo, Calif.

Lidow believes three major factors are heating up power-semiconductor growth. First, intelligent power devices are starting to take away more jobs from electrical and electromechanical devices. "If you start adding up all the relays that are sold, all the copper wire, fuses, relays, and circuit breakers, all of a sudden that's $10 billion a year," he notes. Second, the availability of power ICs with gate-turnoff thyristors that eliminate the task of designing in additional components (such as capacitors, resistors, and protection devices) will result in more design-ins, he says.

Fickle. Joe Van Poppelen, vice president of marketing at National Semiconductor Corp., isn't counting on the fickle consumer to provide the next big market for his semiconductor products. The office offers more promise.

"The third force is probably the biggest, but it's difficult to put a size on it. That has to do with the fact that information is cheap via digital electronics, but all we do with it is print out on paper or light up a phosphorous screen. Power ICs will allow motors to be placed in more places and chips directly to monitor energy consumption of high-rise buildings," he says.

Zilog Inc. believes the emergence of 32-bit microprocessors will lead to a new generation of personal computers that will provide yet another surge in chip demand. "There is more agreement that personal computers built around 32-bit chips will not be just another grown-up brother of the 16-bit systems," says Ed Sack, president of Zilog.

"It will have perhaps more interfaces than keyboards, like touch-screen and voice input," Sack predicts. "And the 32-bit machines are going to be designed for networking and stand alone, unlike the 16-bit systems. There, networking was an afterthought."

Ironically, hopes for the new end-equipment explosion are being fueled by one of the leading culprits of the 1985 market tailspin: depressed memory prices. The 64-K DRAMs selling for $2.50 each last fall are still piling up in inventories at

OUTLOOK FOR 256-Ks IS GLOOMY

Without a major new memory consumer on the horizon, some market projections are being revised downward to reflect slightly less than normal growth in bit shipments of 256-K dynamic random-access memories over the previous 64-K generation. But many chip makers hope that depressed prices will open new applications and quicken the reduction of excess inventories.

"It's getting real doubtful that the 256-K will enjoy a historical increase," says William McClean, a market researcher for Integrated Circuit Engineering Corp. in Scottsdale, Ariz. "That's particularly true with the Japanese and Koreans pushing the life cycle to be short. And then you have the agreement between Philips and Siemens to leapfrog everyone with 1-Mb statics and 4-Mb dynamic RAMs. But everyone is trying to do that now, and they may all end up there at the same time anyway."

In addition to the expensive race to reach higher bit densities, 256-K chips hit the market at a bad time. "The 256-K volumes will not be hitting the market during a shortage, like we saw in the past," notes Jack Morgan, director of MOS memories at Motorola Inc. "You might argue that the 256-K will be off in total bit consumption over the next few years, but we don't see it being catastrophic."

Still, the industry is waiting for DRAM bit demand to jump as work begins on future generations beyond the initial 1-Mb models now in the prototyping stages. The repeated collapse of DRAM markets in this decade has sent a number of U.S. silicon houses in search of new vehicles to help drive leading-edge processes. Static RAMs, which have been less susceptible to price erosions, are being used by more companies as CMOS "process drivers."

Part of the motivation in using other memories as fabrication-learning vehicles is a cooling off of the fine-line processing wars, indicates William Groves of In-Stat Inc., which recently served as host to a forum of chip producers in Scottsdale. "Everyone seemed to agree that it's a design war now. It's a case of who can design the bigger, better IC or memory and sell it cheaper," says Groves, referring to several new techniques such as three-dimensional integration. "The processing challenges have now moved on to the emerging gallium arsenide segment of the solid-state industry."

The demand for large memories is still driving up interest in wafer-scale integration, says Robert R. Johnson, president of Mosaic Systems Inc. of Troy, Mich., which last month announced that it has a working process to incorporate 22 chips on a 4-in. wafer. Using that process, Johnson says Mosaic can offer 8 megabytes of DRAM on a wafer. "The most immediate market knocking on my door is customers using large-scale memories. The chip industry improves densities only by a factor of four. They want more," he adds. **–J.R.L.**

TABLE 2: NONSTANDARD IC SALES TO GROW 31% ($ millions)

Market segment	Year										Compound annual growth rate
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Gate arrays	120	145	265	455	635	790	950	1,100	1,240	1,400	31 %
Linear arrays*	10	25	35	55	80	110	150	200	260	325	47
Total semicustom	130	170	300	510	715	900	1,100	1,300	1,500	1,725	33
Standard cell	12	25	40	90	180	400	750	1,200	1,800	2,500	81
Full custom**	500	550	650	775	925	1,125	1,350	1,625	2,000	2,500	20
Total custom	512	575	690	865	1,105	1,525	2,100	2,825	3,800	5,000	29
Fused logic	33	80	175	260	420	530	635	750	885	1,020	46
Total nonstandard IC market	675	825	1,165	1,635	2,240	2,955	3,835	4,875	6,185	7,745	31

*Includes linear/digital ICs

**Includes some full-custom and standard-cell designed circuitry on the same chip

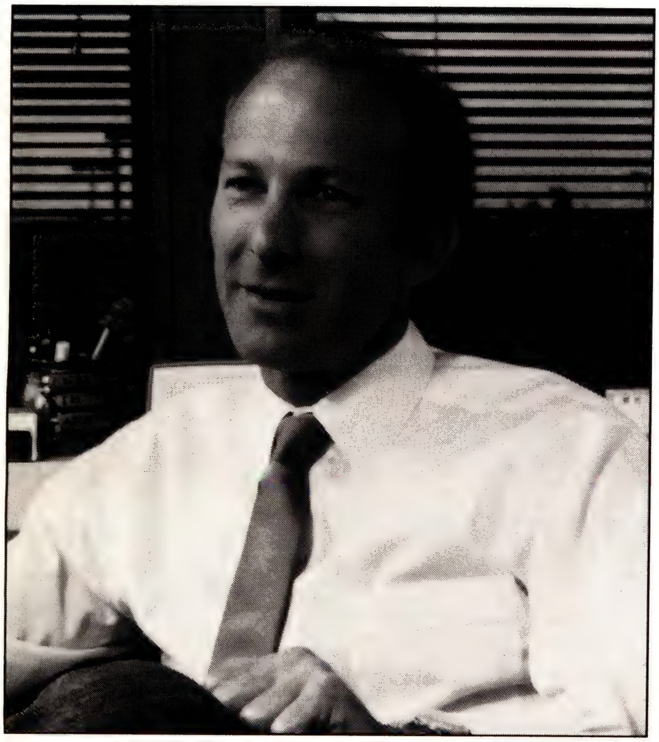
SOURCE: INTEGRATED CIRCUIT ENGINEERING CORP.

prices below 70¢ each. Driven by aggressive production in Japan, prices on 256-K RAMs are also sliding much too quickly for manufacturers to recoup heavy investiment costs of developing the products (see "Outlook for 256-Ks is gloomy," p. 54). But the industry's paradox is, where there are extremely low prices, there is much more hope.

"That's right. We hate to see pricing coming down like it has been, but there is no better evidence in all marketing that semiconductors are purely price-elastic," states Charles M. Clough, president of Wyle Laboratories' chip distributor Electronics Marketing Group in Irvine, Calif. "The lower the price, the more the applications and the more uses for them, and I'm sure it will continue."

Tomorrow's personal computers

To Ben Anixter, vice president of corporate marketing at AMD, the sudden collapse in memory prices "is sowing the seed for the next round of boom because the cost of memories have gone down by a factor of two thirds in just six months." That enables system designers to consider memory-intensive bit-mapped graphics subsystems for low-cost personal computers, which then turns on a new demand for bipolar and MOS processors sold by AMD and its competitors.



Sudden collapse. Continuing declines in memory prices are sowing the seeds of the next recovery because it allows systems designers to consider memory-intensive designs for their products. So thinks Ben Anixter, AMD's vice president of corporate marketing.

Serving up low-cost DRAMs for the insatiable memory appetite continues to be a costly affair for chip producers, however. The crash of 64-K markets has forced massive layoffs at volume DRAM suppliers. Earlier this month, Mostek Corp.—still heavily dependent on DRAM markets despite its three-year attempt to diversify—closed down its Colorado Springs wafer-fab facility and laid off more than 2,000 of its total work force.

Mostek managers admit the MOS house is caught in the DRAM trap. "Once you start introducing other products into a DRAM fab, your efficiencies start to drop off and you end up no longer competitive in the costly DRAM business. You're damned if you do and you are damned if you don't," says one disheartened manager wishing to remain anonymous.

DRAMs—despite the market's wild price swings—continue to be a preferred process-development vehicle for many chip companies. Leading-edge technologies perfected on volume memories are often fanned out through the rest of a product portfolio.

"The reason why we continue to believe in the strategy is that DRAMs force the discipline of high-volume production with the latest technology early on," states William N. Sick Jr., the executive vice president heading up TI's Semiconductor Group in Dallas. For many other companies, the measure of success in fab is falling less on fine lines and tight spaces of a new technology.

Leveraging RAMs

But even companies not participating in volume commercial memory markets have developed their own methods of leveraging high-density RAMs as "processor drivers." Microprocessor maker Zilog designed and processed static RAMs to fine-tune its 3- to 2-μm processes, says Sack.

"The problem with using logic to bring up a new generation of processing technology is that you don't have the repetition you have in RAMs, which are much easier to debug," Sack explains. "We don't intend to sell them." AMD reaps the benefits of DRAM processing while avoiding the volatile DRAM markets because it has chosen to sell memories to selected customers.

Intel's Brooks agrees the bloody price wars of the 1980s have sent many companies searching for alternatives to commodity DRAMs. "It has not yet been demonstrated, however. [But] I think DRAMs are taking on a new personality. I see the market maturing to the point that there are large opportunities in specific applications to support special-feature RAMs." He says DRAMs will continue to be a process-discipline market that pays dividends in other product areas, but "the measure of success is going to change." □

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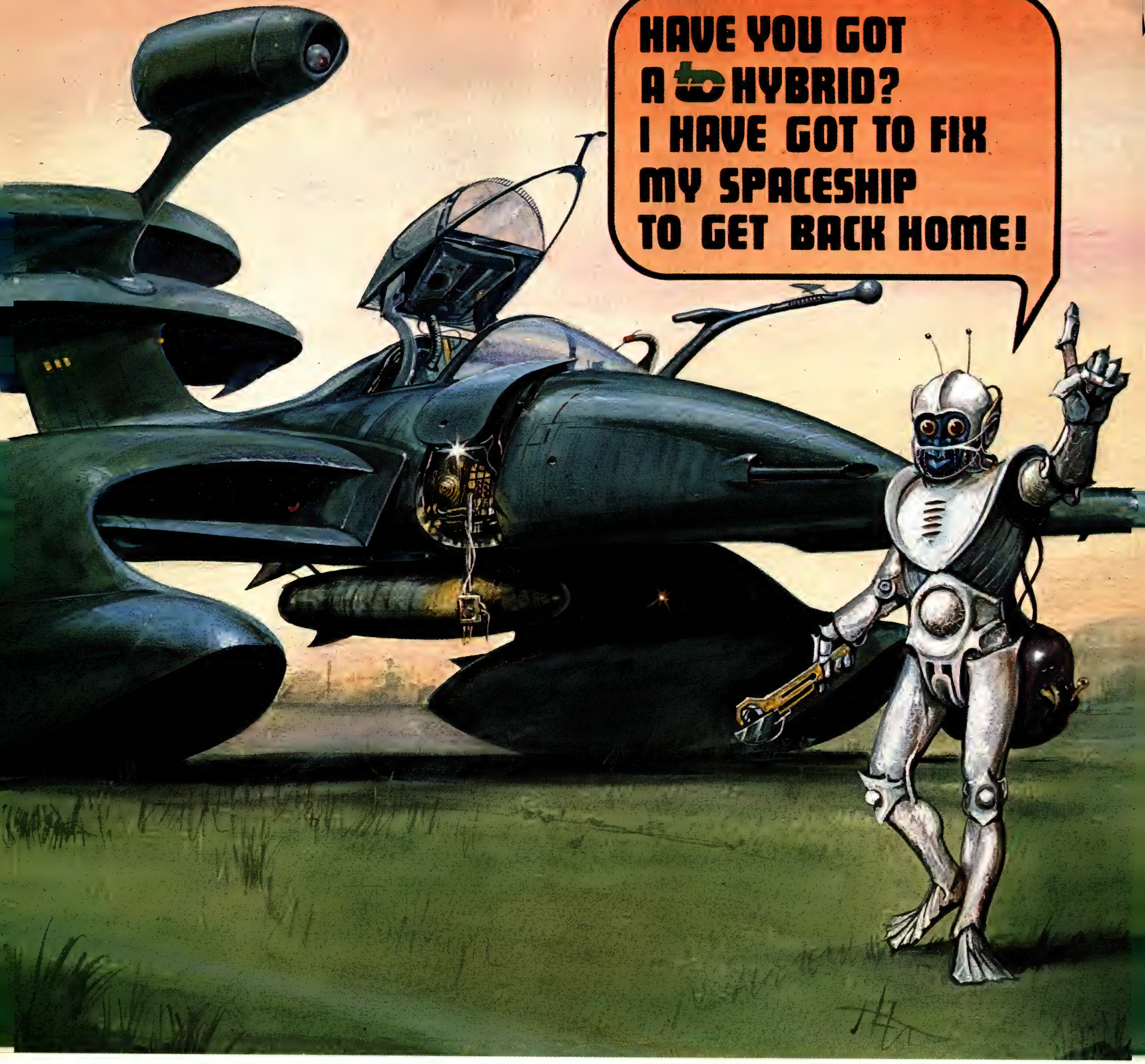
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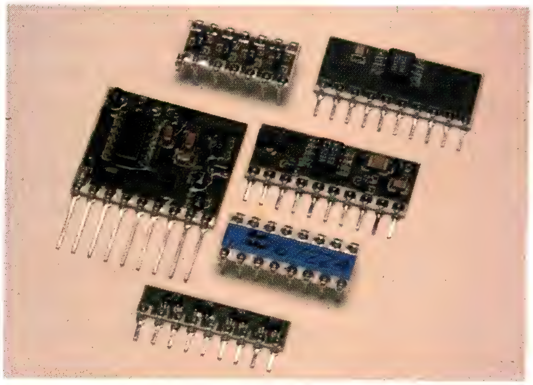

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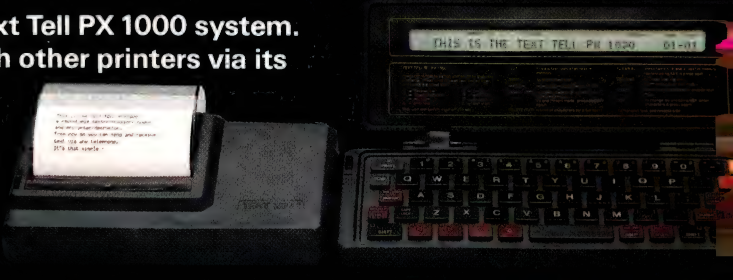

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GRAPHICS INDUSTRY STRIVES FOR NEW NICHES AS MYSTIQUE FADES

by Tom Manuel

TRADITIONAL PLAYERS IN THE GRAPHICS MARKET MAY HAVE TO PROVIDE COMPLETE APPLICATION SOLUTIONS

Since the late 1970s, when computer graphics started going from an esoteric, expensive option to something attainable and even affordable, its growth has been nothing but steep and unfaltering. High-performance color graphics has joined the computing mainstream, showing up in most, if not all, computers with 1,280-by-1,024-pixel displays using 4, 8, or even 16 bits of depth and the 60-Hz refresh rates common at the high end. Thanks to continuing price declines, even personal computers are using graphics, albeit less sophisticated implementations than those found on larger machines.

Why then, despite all the good news, are so many graphics companies in trouble in 1985? The answer lies, at least in part, in the great success of the technology itself. Having so triumphantly made their products integral parts of computer systems, graphics vendors are guilty of removing the distinctions of the technology that once gave it a separate identity.

According to computer graphics consultant Carl Machover, of Machover Associates Corp., there are two other reasons why the traditional players in the graphics market are experiencing what he calls "a pregnant pause" in revenues and earnings. One of them is "that the tremendous surge in graphics technology in the past five years, with its heavy emphasis on very large-scale-integration digital techniques, has taken much of the mystique out of building this specialized technology into systems. This means that many systems companies that were original-equipment-manufacturer customers of the graphics companies are doing their own graphics stuff," says Machover.

The other reason graphics companies are hurting is the emergence and impact of the personal computer. "The initial impact of the personal computer on traditional graphics products is that it is causing clients to defer decisions until they can see where the personal computer fits and what it can do."

However, Machover clearly believes that the current slowdown experienced by graphics companies does not signal a market saturation for graphics capability. "It's just the customers and prospects taking a breath," he says.

"None of these [traditional graphics] companies are doing very well," says Peter J. Shaw, president of Genisco Comput-

World of graphics. A display of computer graphics capability by Precision Visuals Inc. illustrates part of the wide range of picture making that is possible on most computers today with a comprehensive graphics software package such as the company's DI-3000 or GK-2000.

ers Corp., Costa Mesa, Calif. The reason, he believes, is that most of the older graphics companies have not reacted to the integrated-graphics trend and the new market demands.

"They are still selling features, not solutions," Shaw says. "They must shift their focus from graphics hardware to specific application solutions. One way is with software and complete application solutions. Another is to provide a compatible family of products over a wide range of price [and] performance—not just point products [single products that hit the market at just one point on the price-to-performance scale], as many of them have been doing," he adds.

Although the graphics business itself will soon disappear, there are strong and growing niche markets available to companies that can specialize—mostly with application software. Design automation, electronic publishing (primarily for in-house use), business-presentation graphics, very high-quality image rendering for graphic arts and animation, medical diagnosis, and oil exploration are some examples. These specialists will not be selling graphics but will be using the technology to deliver solutions.

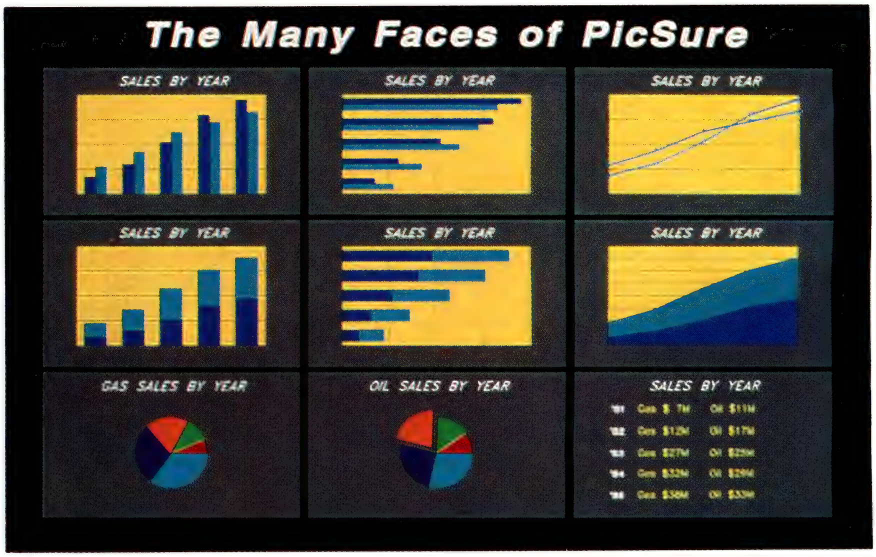
Dark future for general graphics

But the dark future for the broad-based graphics business may in fact be here already. As 32-bit microprocessors continue to become the workhorses of the work-station realm, their multiple-processor designs are opening new uses for application-specific integrated circuits dedicated to graphics functions. The results are improved price/performance for both work stations and personal computers.

The sliding prices and growing capacities of memories are having a big impact as well. At the high end, real-time graphics performance is being achieved, while at the low end, affordable impressive graphics capabilities are becoming a commodity feature.

The swelling ranks of computer users are demanding personal computing functions, whether they are part of a work station for a specialized application or are delivered directly by a personal computer. When the price is right, these same users will jump to a system that also offers sophisticated graphics and color displays, as evidenced by the success of IBM Corp.'s Personal Computer AT, its compatible equivalents, and Apple Computer Inc.'s Macintosh.

The Intel 80286 processor used in the PC AT machines, with its large memory-address capability and coupled with the 80287 computational coprocessor or other available floating-point computational chips, is an excellent power base upon which to build graphics performance. This is equally true for Motorola Inc.'s 68000 series and National Semiconductor Corp.'s 32000 family of microprocessors, with their coprocessors. For designs using the 80286, as long as the system is compatible with PC AT software or equipped with a compatability mode, a wealth of personal computing software is readily available.



Business graphics. Computer data generated from programs or retrieved from data bases can be displayed in many ways by today's graphics software. These bar charts, area graphs, and pie charts are produced from the same data by the Picsure system from Precision Visuals.

One example of advances now possible on personal computers is the solids-modeling system developed by Cubicomp Corp., Berkeley, Calif. The company has turned its initial product into two new families for two different markets.

The Modelmaker family is a series of solids-modeling systems for the computer-aided-design, -manufacturing, -engineering, and scientific markets; Picturemaker has been developed for video- and film-animation applications.

The new high-end system, Modelmaker/500 (see photo on p. 62), a combination of hardware (16-bit add-on frame buffer for personal computers) and software, creates three-dimensional shaded-surface solid models and can display up to 4,096 colors from a palette of 16.8 million. Two software-only products, also for personal computers, the Modelmaker/300 (shaded-surface rendering using up to 256 colors) and Modelmaker/100 (3-d wire-frame models in up to 16 colors), round out the CAD/CAM/CAE product family.

The video animation system, Picturemaker, provides IBM PC users with the ability to produce complex wire-frame models, render these into realistic 3-d solid models, shade and illuminate them with up to 65,536 colors, and then merge them into an animated sequence. This system was good enough to be used for some of the computer-generated sequences in the movie *2010: Odyssey Two.*

Even though the trend to include graphics as an integral part of work stations and personal computers is clear, only a small percentage of the potential users of the computing and graphics combination have so far been served with realistic solutions. An opportunity may exist here for the now-struggling graphics companies, but latching onto it may require strategic alliances and cooperative efforts with other hardware and software suppliers.

To survive, the graphics companies—Shaw's Genisco is one of them—must change. These companies, according to Shaw, typically have been strong in just one area—graphics hardware. To make it today in the computing and information-systems market, Shaw believes, a company has to be strong in at least three of the four key technologies: graphics hardware, computing, software, and communications. The best companies will be strong in all four. Attention to system integration, the product-family concept, and an orientation toward solutions are also important issues.

Graphics integration trends are affecting traditional hardware configurations and classifications. The new graphics-oriented work stations are causing quite a bit of turbulence in traditional waters, such as the minicomputer market. According to James H. Clark, chairman of Silicon Graphics Inc., Mountain View, Calif., "the work-station market is merging into the minicomputer and terminals markets."

To put it more bluntly, work stations are pushing both low-end minicomputers and high-end terminals out of the market.

"Minicomputer companies will either become work-station companies or evolve into mainframe companies as they push up the performance of their superminicomputers," Clark pre-

More examples. Computer graphics technology is spreading to many disciplines and applications today. A sampling shows computer graphics used in computer games and learning systems to aid education (top). Computers can be used to do commercial art design, such as the postage stamp (middle left), or solid-objects modeling for engineering design or illustration (lower left). Visual artists can also use computer graphics to create pictures and illustrations (lower right).

dicts. "Minicomputers in the $20,000 to $40,000 category that do not have graphics will cease to exist; they will become work stations," or die. At the same time, the pure graphics companies are fading, he says, but points out his company isn't one of them; it offers a family of engineering work stations with the combination of plenty of computing power, high-performance graphics, and a stable of third-party software vendors.

To keep his company from fading, Shaw plans to enhance one of Genisco's software developments—Gencor, a graphics data-base management operating system—and use it to develop packages for selected vertical applications. To serve a range of price/performance needs, Shaw envisions Gencor as a host computer package serving inexpensive terminals at the low end. For the midrange, Gencor software would run in the work station, and at the top end, Gencor could be in silicon in a high-performance work station.

Tektronix Inc., Beaverton, Ore., one of the first graphics companies, is also recognizing the changing realities of the marketplace. The company is providing more computer and communications functions in its graphics products and is now also in the work-station business.

Solidity. Cubicomp's Modelmaker/500 solids-modeling system for IBM Personal Computers and compatible systems allows 3-d, shaded-surface solid models to be created with high resolution and up to 4,096 colors on the screen at one time.

Just last month, Tektronix reorganized its Information Display Group into four new divisions to better serve the needs of its customers, according to Jon Reed, the group's vice president and general manager. "The needs of our traditional graphics customers have changed dramatically over the past few years," he says. "The customer is demanding more intelligent products."

This intelligence goes beyond simply combining graphics and computers. If the growth of work stations and personal computers is to continue to the point where nearly every worker will have one, the key will be that these tools "must become people-literate, as opposed to the the people becoming computer-literate," says Paul Huber, president and chief executive officer of Megatek Inc., San Diego. Both graphics and artificial-intelligence technologies will have to be applied to achieve this goal. VLSI and the next levels of circuit integration will play a key role, "but the real key is software to solve customer problems," says Huber, who is echoed by almost everyone else in the computer industry.

Software lags

To deliver the benefits of the flashy graphics hardware now available or just over the horizon in the form of real applications requires more investment in software. At the current stage of graphics technology evolution, the most important and significant developments must happen in software because graphics hardware development is ahead of software. Even though many of the basic graphics functions are moving into hardware, there is still a need for a level of what could be termed systems software to support the graphics needs of applications. In this realm, standards are taking on an increasingly important role. These operating system- and device-independent software standards make it easier to produce application packages that run on many systems.

However, there is a tradeoff involved between speed and standards. According to Peter Palij, planning manager at Lexidata Inc., Billerica, Mass., "the more standard you become, the slower you get." But standards are good for software developers who want products to run on as many systems as possible with as little change as possible. But both software and hardware vendors want to be able to offer the fastest system. As some of the standard graphics primitives move into hardware, this tradeoff may become less agonizing.

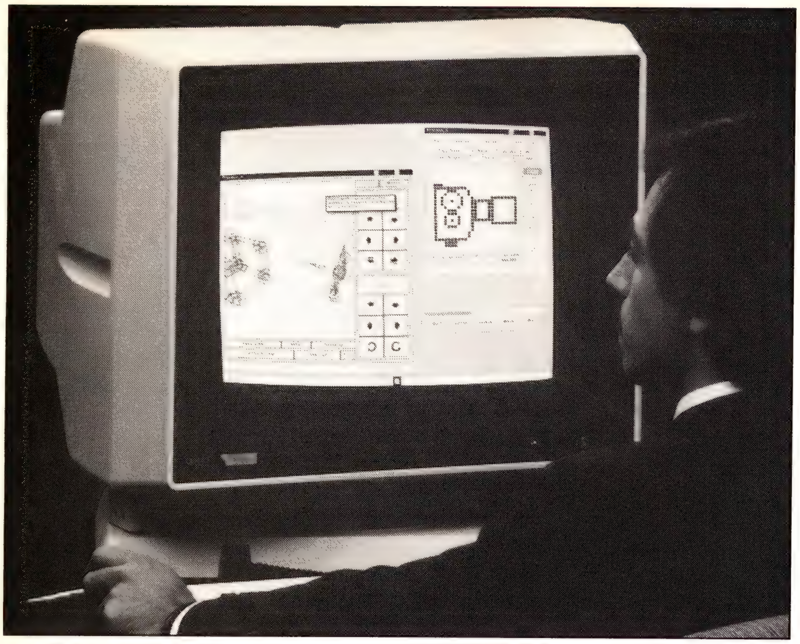
Several comprehensive graphics packages based on emerging standards are serving as foundations on which to build portable applications. Two examples—out of many—of graphics support packages based on the proposed American National Standards Institute and International Organization for Standardization (ISO) Graphics Kernel System standard are the GK-2000 from Precision Visuals Inc., Boulder, Colo., and the GSS-Toolkit Kernel System from Graphics Software Systems Inc., Wilsonville, Ore. Many graphics software tools are also using the proposed ANSI Virtual Device Interface standard, where all graphics software except the small device drivers is independent of the characteristics of input and output devices.

The Graphics Metafile Resource (GMR) integrated graphics resources system developed by Apollo Computer Inc., Chelmsford, Mass., is one example of a different approach. Paul Henderson, senior product manager for graphics software at Apollo, says that GMR "represents a new generation of graphics capabilities. It is a superset of our Domain core and Graphics Primitive Resource systems."

Apollo decided to maximize both graphics throughput and integration with GMR—it is really an integral part of the application display manager in the Domain system—and all users get it as part of the system. "GMR moves the graphics work closer to the machine," says Henderson. "It's now in lower-level firmware; potentially, it could be in hardware." Yet GMR provides high-level functions to programs. GMR is one example of the trend to graphics integration, as it is really a part of the system architecture.

Also, there is a trend toward more graphical user interfaces, along the lines of the Apple Macintosh. Several packages, such as Digital Research Inc.'s GEM, Microsoft Inc.'s Windows, and the newly released Dialogue from Apollo [*ElectronicsWeek*, April 22, 1985, p. 14], are being readied for market (see photo on p. 63). The goal of these packages is to make it easier to build application programs with user interfaces using windows, icons, and pointing devices. But general-purpose window and icon packages are a problem because they affect system software, making them a little slow in coming. However, GEM and Dialogue are available now and Microsoft's Windows will be delivered next month.

More parts and functions of graphics technology are moving into hardware and firmware. The graphics field has grown



Doing windows. Graphical user interfaces for applications using windows and icons are easy to build with Apollo Computer's Domain/Dialogue system. It offers software developers a selection of icons, scroll bars, pop-ups, and help facilities.

to the point where the semiconductor industry sees an opportunity for enough volume to make it cost effective to develop parts to support this application.

Paul Norman, senior marketing specialist for Data General Corp., Westboro, Mass., graphics, says one of the major graphics trends is development of dedicated hardware "to do the things that sophisticated software packages do now, such as shading surfaces, hidden-surface removal, ray tracing, and texturing." Using ICs, gate arrays, and other semicustom or custom VLSI chips to bring high-performance hardware closer to the user by taking over some of the standard software jobs does more than increase performance. It improves the reliability of systems while reducing their cost and size.

Into the chips

Weitek Corp., Sunnyvale, Calif., besides developing a large family of floating-point computation chips that can be used in graphics systems, has a tiling chip, tiling engine, and solids-modeling engine for high-performance graphics systems. The tiling chip, a key part in Weitek's board-level (two-board) WTE 6300 Tiling Engine—in turn a part of the three-board solids-modeling engine—helps shade polygons while removing hidden surfaces for realistic 3-d display of solids.

The full-custom tiling chip uses a high degree of parallel processing to achieve very high speed. When using 64-K dynamic random-access memories on its Z-buffer board, the tiling engine handles 512 by 512 pixels in one pass—four passes are required for 1,024 by 1,024 pixels. But with 256-K DRAMs, a 1,024-by-1,024 resolution can be handled in one pass.

The complete WTE 7300 solids-modeling engine is one example of special-purpose graphics-function engines that do graphics work with no load on the host processor; another is the Geometry Engine developed by Silicon Graphics Inc. [*Electronics,* Oct. 20, 1983, p. 117]. The Weitek solids-modeling engine performs high-speed 3-d rotation, translation, scaling, clipping, perpective division, tesselation, and light-source modeling in the transformation-processor board, which uses Weitek's 32-bit floating-point-processor chips. The tiling engine, the other half of the solids-modeling engine, performs hidden-surface removal, Gouraud shading, solid-object sectioning, and translucency calculations.

The Geometry Engine is a VLSI custom chip that can be used in different pipelined configurations to do fast scaling, clipping, and floating-point calculations such as matrix multiplication.

The first specialized graphics devices were graphics or video processor chips, bit-map controllers, and very-high-speed floating-point-processing chips. More recently, dual-ported video RAMs for graphics systems are entering the picture. As RAM technology got more and more dense and, therefore, much cheaper per bit over the last few years, graphics controllers and displays with very high definition (1,024 by 1,024 or 1,280 by 1,024 pixels) became feasible for $30,000 to $40,000 work stations. Gene Chao, chairman and chief executive officer of Metheus Corp., Hillsboro, Ore., says "developments such as 256-K memory chips organized as 64-K-by-4-bit with dual ports will overcome the access problem of single-port 256-K-by-1-bit RAMs and allow the high-definition graphics to come down to the $3,000 to $5,000 work-station range in a year or two."

One such RAM for graphics applications has been announced. A 256-K dual-port memory was announced by NEC Corp. at last February's International Solid State Circuits Conference. Video RAMs (or VRAMs) such as NEC Corp.'s μPD41264 chip and the earlier Texas Intruments Inc. 64-K TMS4161 part eliminate the memory bottleneck occurring when the processor that is calculating which bits to change in the bit-map memory clashes with the display circuitry refreshing the display screen on the I/O port of single-ported memories. The new VRAMS give the processor and the refresh circuitry unobstructed access to the bit map by providing a second port, complete with a serial read buffer for the refresh, freeing the standard random-access port for exclusive use by the processor.

The NEC graphics RAM is in two parts. The first, a 64-K-by-4-bit DRAM with a random-access port that allows writing one bit at a time, facilitates quick color changes. The second part is a 256-by-4 serial read port consisting of a 1,024-bit data register and a 256-into-1 multiplexer. The serial readout can be started and stopped at any location without idle time, making vertical scrolling simple—it can be done by just changing the start address of the refresh bit-stream.

In the graphics-display controller field, Intel Corp., Santa Clara, Calif., has recently announced an enhanced version of its 82720 chip that is twice as fast as the previous version. The 82720 is Intel's alternate-source version of NEC Corp.'s 7220, one of the first graphics-controller chips. NEC also has a faster version of the 7220, called the 7228—6-, 7-, and 8-MHz speeds versus 4, 5, and 5.5 for the 7220.

Hitachi Ltd. has a new graphics chip, the HD63484 ACRTC (for advanced CRT controller). The chip is a CMOS circuit for low-cost high-performance graphics systems. It is able to off-load many graphics functions from the main processor. While most conventional CRT controllers provide only display control, the HD63484 adds a high-level graphics command set. It has drawing functions such as line, circle, ellipse, paint, and copy added to the usual display functions, including split screen, windows, and smooth scrolling.

With a clock rate of 8 MHz, the chip can do line drawings at 500 ns/pixel. The chip contains about 117,000 transistors, which are used to make up its multiprocessor structure. There are three processor modules for drawing, display, and timing.

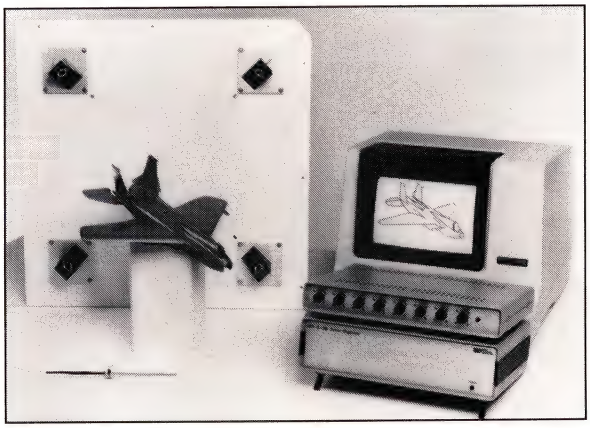
The HD63484 can be used as a peripheral chip loosely coupled to the central processing unit, and controls all access operations to the frame buffer for drawing graphics and displaying them on the CRT. Therefore, the frame buffer can be separated from the main memory so that CPU software and the drawing functions can be performed in parallel. □

FANCY PERIPHERALS DOMINATE THE GRAPHICS MARKETPLACE

A ROUNDUP OF SOPHISTICATED GRAPHICS PERIPHERALS

No matter what happens to the nuts and bolts of the graphics industry—the work stations and the associated software—graphics peripherals will always have a place in the sun. Whether graphics remains a separate entity or goes the way of word processing, becoming merely a computer application, the need for better and brighter peripherals will remain strong.

In fact, according to figures prepared by graphics industry analyst Carl Machover, president of Machover Associates Corp., White Plains, N.Y., peripherals make up a little less than half of the expected $3.2 billion in sales this year. Worldwide sales of peripherals, which include displays, hard-copy devices, and other equipment such as mice and digitizers, will total $1.58 billion compared with $1.62 billion for graphics systems and software, he says. And there is little sign of a letup: he foresees the industry growing at 37% a year.



Sweet sounds. Even inaccessible areas can be digitized with a digitizer from Science Accessories Corp. that uses sound waves and microphone sensors to create XYZ coordinates.

Input devices and displays are being refined, and output devices continue to strive for quality a master painter could be proud of. Though it was a quiet time for the traditional systems makers, last month's National Computer Graphics Association show in Dallas was a bonanza for peripherals manufacturers as they unveiled a bevy of new products.

Available for the IBM Corp. Personal Computer, the PC/XT, 3270, and compatibles with standard RS-232-C serial interfaces, the Sweet-P mouse has a completely shielded drive mechanism to reduce or eliminate maintenance. Leaf springs keep a constant load on the Sweet-P mouse's urethane XY drive wheels, which are directly coupled to encoders. The Sweet-P mice from Enter Computer Inc. are compatible with most mouse-driven software and sell for $179.

Two digitizers, one integrated with Apple's Macintosh system, the other, using sonic technology, offered for computer-aided design, come from GTCO Corp. and Science Accessories Corp., respectively. The Macintizer plugs directly into the mouse port and can be operated without any modification to the operating system or applications software, GTCO says. The Macintizer works with MacDraw and MacPaint.

The model GP-8-3D-P sonic digitizer uses sound waves to determine the distance between a digitized point and four microphone sensors that are mounted on a plane. The host computer then converts these into XYZ coordinates. The host computer can also select point-trace mode, output format, and the number of locators to be used. Ferrous substances can be digitized, as well as points not ordinarily accessible, according to Science Accessories Corp. The active area can be adjusted up to 10 by 10 by 10 in. with 0.01-in. resolution throughout. Consisting of a free digitizing locator—it has no arms or linkages—a control unit and four microphone sensors, the GP-8-3D-P is priced at $7,500 per unit.

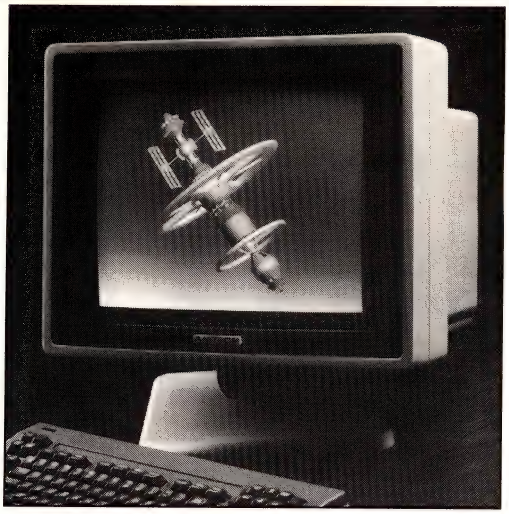
Available in both two-dimensional and three-dimensional configurations, Industrial Technology and Machine Intelligence's (ITMI) GTR is a real-time machine-vision preprocessor. The GTR 2D converts standard video input from vidicon-tube cameras or charge-coupled-device cameras to an image with 64 levels of gray. The GTR's firmware combined with its pipelined architecture allows the generation of 60 images/s. GTR's software is based on real-time gradient analysis and contrast-point definition, so that the system can recognize a part from its shade. This technology is inherently light-independent and therefore no special lighting is required. The GTR 3D differs from the 2D by the addition of a laser-signature-analysis capability, so the unit can generate images at the same 60-images/s rate. The GTR 2D can be connected to any computer that supports a direct-memory-access interface; the GTR 3D requires only a standard parallel interface. Each unit is available for $6,000: ITMI also supplies integrated vision controllers and software.

Weighing 40 lb and offering a 30% reduction in footprint, Amtron Corp.'s 19-in. color graphics display monitor has a footprint nearly that of a 10-in. monitor. The CD1920's 150-MHz bandwidth permits rapid rise and fall times for a sharp, bright display: it has a low parts count, resulting in a calculated mean time between failure of over 16,000 h.

Other features include automatic vertical synchronization up to 180 Hz and a 1,280-by-1,024 resolution. The CD1920 will also be available later with a 1,580-by-1,260-pixel resolution. The monitor, priced between $2,000 and $3,500, depending on quantity and configuration, can be connected to any graphics generator.

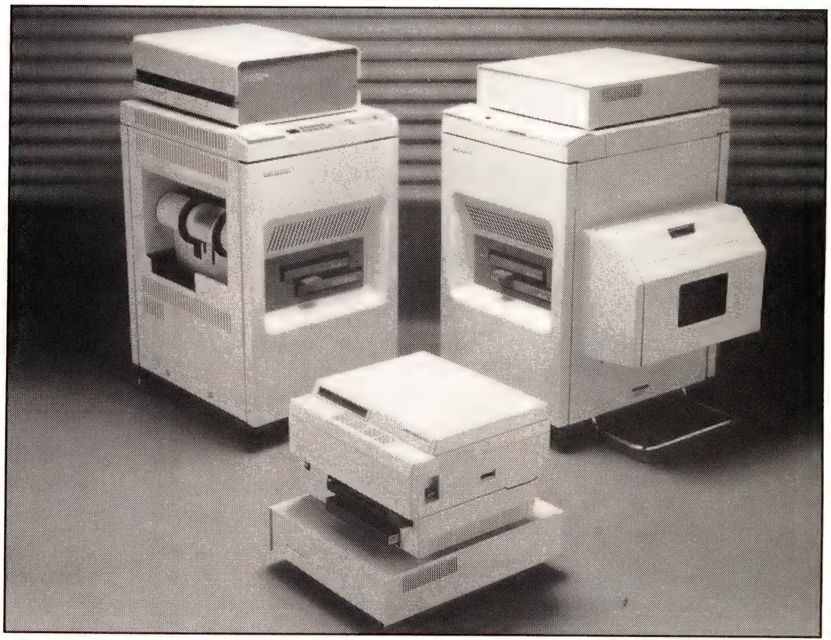
Lundy Electronics & Systems Inc.'s GTC-327 graphics terminal can emulate a Tektronix Inc. 4027 so that customers can run existing software without modification. A custom software service is also available. The GTC-327 provides a resolution of 640 by 480 pixels and simultaneously displays eight colors from a palette of 4,096. The screen measures 10 in. and graphics primitives are included.

Robotic plotter. Penman looks like a mouse but is really a robotic three-color plotter that can sense obstacles as it moves about on a sheet of paper. Because the pen is the third apex of a triangle formed with the two drive wheels, the plotter can draw straight lines and accurate curves without having to turn and face in the direction it is drawing, the company says. Two built-in optical detectors locate "home" position—the left-hand corner of the paper—before it begins to draw. The user can make it return to check its position during a plot at any time, so that positional errors do not accumulate during long, complicated plots. The robot plotter, which can also be used as a mouse, connects to any computer with an RS-232-C interface and calculates and adjusts to the baud rate of the host computer. The control box and the 5.0-by-4.5-in. robot are connected by a ribbon cable. The price is $449.95.



Plentiful. With 0.31-mm dot pitch, this terminal (left) from Amtron Corp. has a display resolution of 1,280 by 1,024 pixels. As an option, the terminal can be fitted with a tube that uses 25-mm dots to boost resolution to 1,580 by 1,260 pixels. The terminal's screen measures 19 in.

Three's company. This family of laser printers from QMS (below) produces 8, 12, and 24 pages/min, respectively. Twelve fonts come standard with each model, suiting them for such applications as in-house publishing. The printers' controllers have a 1.4-megabyte bit-map page memory.



Two drum-type pen plotters from Nicolet, the Zeta 824CS and Zeta 836CS, handle single-sheet as well as roll-fed media. In the cut-sheet mode, the eight-pen plotters allow a variety of drawings to be reproduced on preprinted forms, while the roll-feed mode plots drawings up to 120 ft long. Despite varying sizes of vectors, drawing speed is rated at 20 in./s. The 824CS and 836CS handle 24.5-in. and 34-in. wide media, respectively. The Zeta 824CS is priced at $11,900, the Zeta 836CS at $14,900, with quantity discounts available.

The CP-VII dot-matrix printer uses seven rotating platens to print seven different colors in a density of 120 dots/in. Draft text printing throughput is 180 characters/s, and near-letter-quality is handled at 90 c/s. At this time the manufacturer, Cal-Abco, is offering free a utility program, Legend Paint, that supports full-color screen dumps to the CP-VII printer (suggested retail price $1,195). Legend Paint runs on IBM PCs and compatibles and is bundled with the Lotus color-driver utility: it requires 128-K of memory only in the host computer. The program will generate charts from number data, merge files, and store image files for future use with new graphics.

Five fonts. An intelligent ink-jet printer from Digital Equipment Corp. contains the firm's J-11 microprocessor; it handles both paper and transparencies. Resolution is 154 dots/in., and eight true colors can be combined to create up to 216 different tints and shades. Compatible with several of DEC's own computers and office software, the LCP01 is also compatible with several protocols of third-party packages, including North American Presentation Level Protocol Syntax. Graphics can be generated and reviewed on a low-resolution terminal, then printed on the LCP01 in portrait or landscape mode. The printer's memory holds up to five fonts.

Resolution of 300 by 300 dots/in. is offered on Quality Micro Systems Inc.'s Lasergrafix family of intelligent, laser page printers, the models 800, 1200, and 2400. (The model number indicates the number of pages—8, 12, or 24 printed per minute.) Page memory bit-maps up to a legal-sized page, and commands in the Quic programming language simulate Qume and Diablo printers. Each model comes with 12 fonts, and with the optional phototypesetter simulations, the printers can function as part of an in-house publishing operation. Prices range from $7,995 to $29,995.

Pixel-for-pixel plotting is the advantage of Benson Inc.'s Color Imaging System compared with traditional eight-color pen plotters, the company says. The system works by teaming the Colorscan 800, Benson's ink-jet color plotter, with the Color Image Processor (CIP). Up to four work stations can share the system, in which screen images are sent to the CIP for complete plotting in less than 5 min, freeing the work station to perform other tasks. The Colorscan 800 and the CIP are offered for under $25,000. *–Ann Jacobs*

FOR MORE INFORMATION CONTACT THE FOLLOWING COMPANIES:

Enter Computer Inc., 6867 Nancy Ridge Dr., San Diego, Calif. 92121. Phone (619) 450-0601 [Circle reader service number 390]

Science Accessories Corp., 970 Kings Hwy. W., Southport, Conn. 06490. Phone (203) 255-1526 [Circle 391]

GTCO Corp., 1055 First St., Rockville, Md. 20850. Phone (301) 279-9550 [Circle 392]

ITMI Marketing Corp., 1000 Massachusetts Ave., Cambridge, Mass. 02138. Phone (617) 576-2585 [Circle 393]

Amtron Corp., 2260 De la Cruz Blvd., Santa Clara, Calif. 95050. Phone (408) 748-8500 [Circle 394]

Lundy Electronics & Systems Inc., 1 Robert Lane, Glen Head, N.Y. 11545. Phone (516) 671-1900 [Circle 395]

Penman Products Corp., 705 N. Bowser, Richardson, Texas 75081. Phone (214) 238-1815 [Circle 396]

Nicolet, Computer Graphics Division, 777 Arnold Dr., Martinez, Calif. 94553. Phone (415) 372-7568 [Circle 397]

Cal-Abco, 6041 Variel Ave., Woodland Hills, Calif. 91367. Phone (818) 704-9100 [Circle 398]

Digital Equipment Corp., 77 Reed Rd., Hudson, Mass. 01749. Phone (617) 568-4000 [Circle 399]

Quality Micro Systems Inc., P.O. Box 81250, Mobile, Ala. 36689. Phone (205) 633-4300 [Circle 400]

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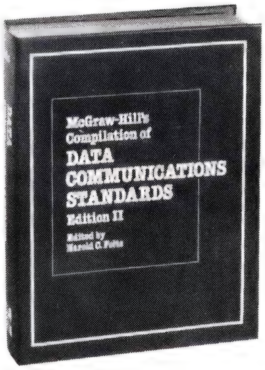

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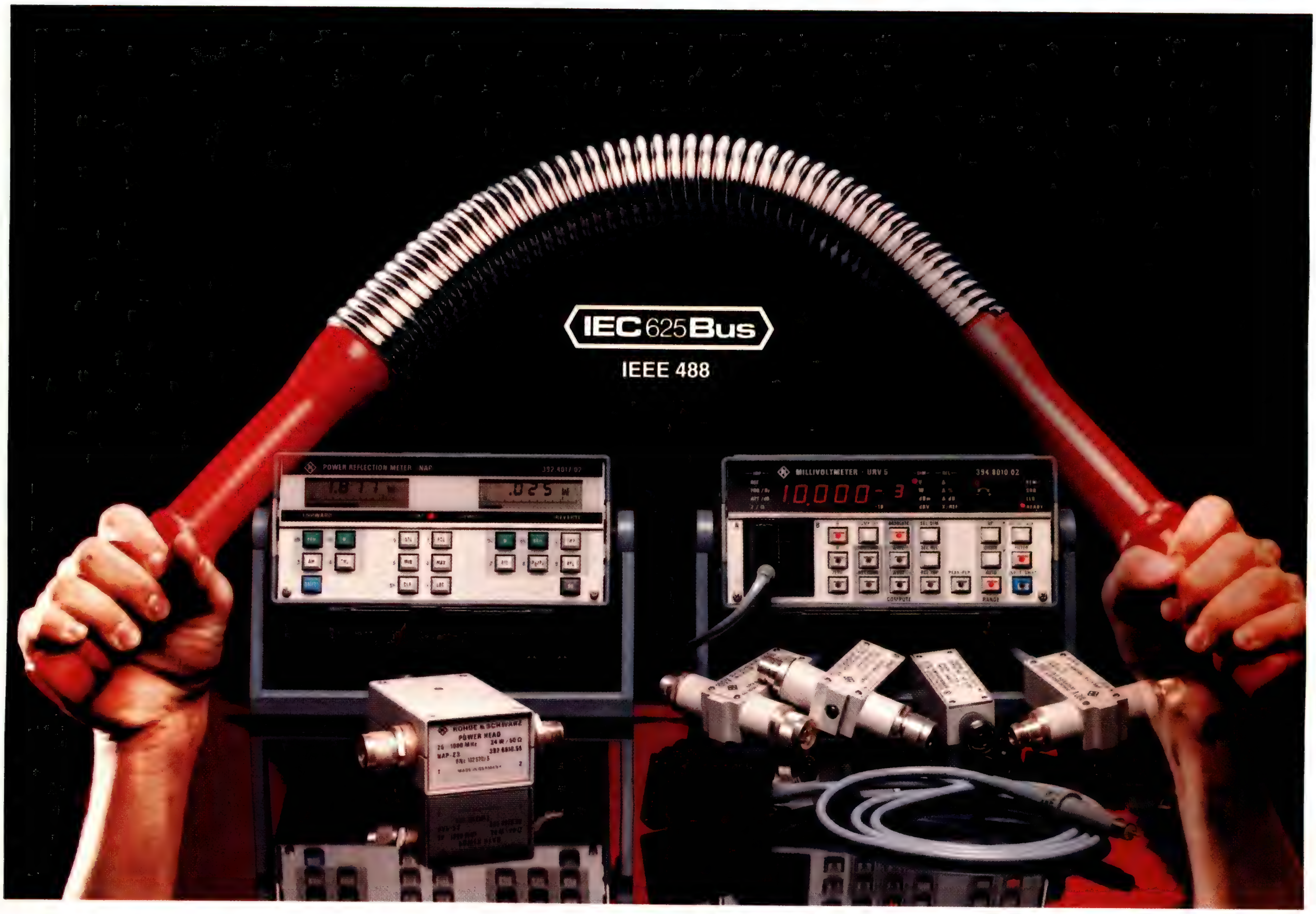

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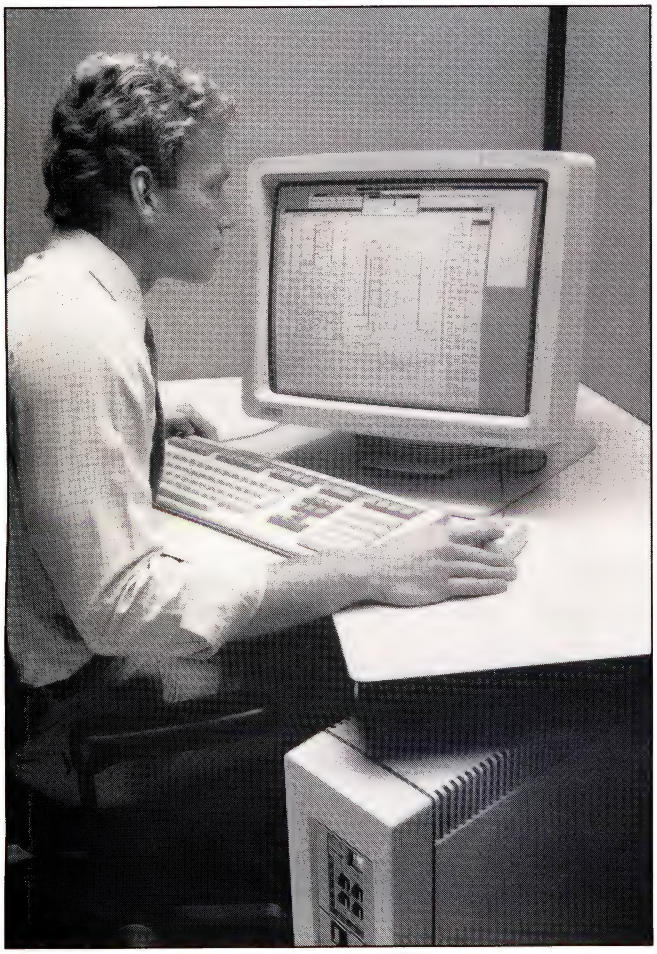
DEC'S LATEST WORK STATION USES THE VAX-ON-A-CHIP

$19,000 system challenges VAX-11/780 in CPU performance

Digital Equipment Corp. calls it MicroVAX II or VAXstation II, but it may yet become known as the Apollo-fighter. These are the new DEC machines positioned to make headway into the engineering-work-station market that has provided a feast for Apollo Computer Inc. and others, such as Sun Microsystems Inc. Featuring the VAX-on-a-chip and its matching floating-point processor, the machines provide a significant boost in price-performance ratio over older VAX products. In fact, the boost is so significant that the only down notes sounded in reaction to the MicroVAX II introductions are related to their potential effect on lower-end VAX products.

Some analysts suspect that the new products, none of which will be in volume supply for some months, will depress demand for VAX-11/725s and 11/730s to a terminal level. They are asking, why buy those machines when the MicroVAX II, starting at under $19,000, provides for some applications 90% of the CPU power of DEC's 11/780 CPU?

Although the MicroVAX II is said to be a full member of the DEC VMS operating system family, with all the software transferability and user-familiarity that implies, unlike others in the VAX line, the MicroVAX II cannot be clustered. Reports are that DEC will postpone clustering the baby VAX for about two years. For now, interfaces to the cluster cost more than the MicroVAX II itself.



DEC's ability to penetrate the work-station market heretofore dominated by others is enhanced by its existing presence in the technical marketplace. Adam Zais, a program manager at International Data Corp., says that 38% of those sites with computer-aided design systems have DEC processors. Nevertheless, its previous attempt to break into this business with the MicroVAX I was criticized for providing insufficient computing power and was offered initially without VMS operating system compatibility.

Michael Gallup, director of product marketing at Apollo Computer, grants that the new products from DEC are aggressively priced, but says Apollo remains a leader in the ability to network large numbers of work stations and allows customers to plug into those networks with diskless nodes for less than $10,000. In the area of graphics, Gallup says Apollo also retains a leading position, at least partly because color is not yet offered on the VAXstation II. Still, he concedes that near-term competition (in the absence of a product from IBM) will come primarily from the MicroVAX II.

Beta-site reports on the MicroVAX II indicate that this time out, DEC has provided nearly complete VAX compatibility with the MicroVMS operating system. (Also available for the new products is Ultrix-32, a DEC version of AT&T Bell Labs' Unix operating system.) Though DEC disdains talk of millions of instructions per second as a performance measure, it pegs the MicroVAX II at 0.9 mips, with the qualifier that performance is heavily application-specific.

"DEC has a hot machine here," said Steven B. Davis, director of new product development for Signal Technology Inc., after running Signal's fast Fourier transform program on a VAXstation II. Davis's figures show that a VAX-11/780 with a floating-point accelerator takes 12.7 s to do 100 operations of the FFT; the VAXstation II with the floating-point chip takes 18.1 s.

Applicon, a Burlington, Mass.-based operating unit of Schlumberger, will use the MicroVAX II in its Aria II family of work stations. Frank Donlan, director of engineering, says he's worked with the products since February and has been favorably impressed. "We built our software on a different machine, transferred it to the MicroVAX II, and had it running in days," says Donlan. "It was really painless. I was totally surprised. And the hardware was really clean. I couldn't find a jumper on the board—they just had none of that." Donlan adds that Applicon can now put all software that runs on the top-of-the-line VAX 8600 on the MicroVAX—and "that's just remarkable."

At the heart of the new systems is the VLSI VAX-on-a-chip processor, formerly called the MicroVAX 78032. The 32-bit chip contains 125,000 transistors, but it is an n-MOS and not a CMOS device. The decision to use n-MOS was made at the start of the 33-month development process in 1982. At that time, explained Bob Supnik, MicroVAX II-chip project manager, DEC was reluctant to risk development work in CMOS technology. "Future technology will be CMOS," he says.

DEC maintains that the inclusion of demand-paged virtual memory on the VAX chip makes it unique. The chip is housed in a 68-pin surface-mounted package (requiring a single +5-V

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Materials • Machinery • Instrumentation • Technology dc power supply) and is TTL-compatible. It includes 32-bit internal and external data paths, pipelined architecture, and instruction prefetch. The architecture has four gigabytes of virtual address space, its own 20-MHz clock generator, sixteen 32-bit general-purpose registers, and 31 interrupt levels.

To accelerate performance, the VAX-on-a-chip is paired with a floating-point chip, the MicroVAX 78132, that DEC says gives 85% of the floating-point performance of the 11/780 with a floating-point accelerator. The 78132 is packaged in a 68-pin ceramic package and handles single-precision, double-precision, and extended-range double-precision VAX-11 floating-point data types.

DEC further announced a new ½-in. cartridge tape drive, the TK50, and a new high-end fixed 5¼-in. Winchester disk drive, the RD53, with 71 megabytes of formatted capacity and an average access time of 38.3 ms. Both are used in the MicroVAX II systems.

Two MicroVAX II systems are being offered, each in two configuration packages with prices from $18,840 to $43,780. Housed in a pedestal enclosure, the BA 23 is a single-user entry-level Ethernet node with 2 megabytes of main memory, a 31-megabyte Winchester disk subsystem, and a 400-K-byte dual floppy-disk subsystem.

Also offered in the BA 23 is an entry-level four-user stand-alone system that differs from the basic node in that it is provided with the RD53 71-megabyte hard disk, the TK50 95-megabyte streaming cartridge tape drive, and a four-line asynchronous multiplexer. An eight-user department system features 3 megabytes of main memory, 71-megabyte hard disk, dual floppy-disk subsystem, tape drive, and an eight-line asynchronous multiplexer. Designated the BA 123, the system is housed in a freestanding cabinet.

The product line is topped out by a 16-user system. It has 5 megabytes of main memory, three 71-megabyte hard disks, a tape drive, and two eight-line asynchronous multiplexers. The VAXstation II is offered in two basic configurations. A basic system, which sells for $26,500, includes 2 megabytes of memory, a bit-mapped video-graphics system, DECnet/Ethernet local-area-network interface, 19-in. monochrome monitor with 1,024-by-864 pixel resolution and 60-Hz refresh rate, dual 400-K-byte 5¼-in. floppy disk and internal 31-megabyte Winchester disk. Also included is a mouse with three function keys and a keyboard with 15 function keys. The MicroVMS operating system and MicroVMS work-station software emulates VT100 and Tektronix 4014 terminals for both systems.

The high-end VAXstation II is supplied further with the 71-megabyte disk and the 95-megabyte cartridge drive in place of the floppy-disk drive and 31-megabyte hard disk. Hardware options include memory-expansion modules up to 9 megabytes, an external 31-megabyte Winchester hard disk, and a variety of printers. DECnet for both local- and wide-area networks is a communications option. *–Craig Rose*

Digital Equipment Corp., 146 Main St., Maynard, Mass. 01754. Phone (617) 897-5111 [Circle reader service number 338]

IBM AT-compatible comes with color graphics controller

While its competitors entered the IBM Personal Computer AT-compatible market with much fanfare, Corona Data Systems Inc. quietly introduced its version, a transportable unit with a built-in color video graphics card. The 80286-based machine, which runs MS-DOS, can operate as a stand-alone computer or as a work station to the desktop PC AT.

The ATP is available in two models. The ATP-6-QD features one 1.2-megabyte floppy-disk drive, one 360-K-byte floppy disk drive, and 512-K bytes of main memory. The ATP-6-Q20 has a 20-megabyte hard drive in place of the 360-K-byte floppy.

The system runs at 6 MHz and has a socket for an 80287 floating-point math coprocessor. The screen's resolution, 640 by 400 pixels, is about twice that of IBM's PC AT.

The 38-lb unit is priced at $4,500 for the QD version and $5,500 for the Q20 model. Delivery will begin in June.

Corona Data Systems Inc., 275 East Hillcrest Dr., Thousand Oaks, Calif. 91360. Phone (805) 495-5800 [Circle 349]

Multiuser system has software for real-time processing

One of the microcomputer pioneers, Ohio Scientific, is introducing a series of 32-bit muiltiuser computers. The OSI 710 and 720 both run RTIX, a Unix-like language with real-time processing capabilities.

Software written to run under Unix versions 6 and 7, Systems III and V, Xenix, and the pending IEEE Unix standard can also run under RTIX, the company claims. Based on the 68010 microprocessor, the OSI 710 has 2 megabytes of memory, expandable to 8 megabytes, with from 20 to 120 megabytes of mass storage. In a basic configuration, it will support six users but can be expanded to serve 16.

The OSI 720, which serves 16 users in its basic configuration, is expandable to serve 32. It uses three microprocessors—68010 as the CPU and a 68000 and 68008 as coprocessors. It offers from 2 to 16 megabytes of RAM and has a 50-megabyte Winchester disk drive and 5¼-in. floppy-disk drive. Both systems come bundled with Uniplex II, an integrated package that combines a data-base manager, spreadsheet, word processing, and electronic-mail functions and Mimer, a relational data-base management system. The 710 will sell for $10,500, and the 720 unit, for $14,000. The 710 will be available in the second quarter and the 720 in the fourth. The computers are manufactured by Isotron Inc.

Isotron Inc., 140 Sherman St., Fairfield, Conn. 06430. Phone (203) 255-7443 [Circle 380]

VME graphics controller draws 12 million pixels/s

High-performance graphics is now available using the VME bus interface with the 600-V two-board controller set. The 600-V draws at 12 million pixels/s and provides a 640-by-480-pixel display resolution.

The controller features dual-ported video memory, RS-170 video compatibility with generation-sync lock, two frame buffers, zoom, smooth pan, and scroll. Double-buffered controllers provide dejagging, dithering, and interactive drag and paint functions. The instruction set includes commands for polygonal, box, circle, and vector drawing, and solid fill, outline,

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The 600-V graphics controller is priced at $5,000, with delivery 30 to 60 days after receipt of order.

Parallax Graphics Inc., 1095 E. Duane Ave., Sunnyvale, Calif. 94086. Phone (408) 720-1600 [Circle 343]

Portable instrument performs demarcation testing

A portable battery-powered instrument, the 1180 provides all transmission quality testing, signaling simulation, and return-loss testing capabilities required for network-demarcation testing. With the 1180, circuits can be completely tested without access to a PBX or terminal equipment.

Because the 1180 can simulate PBX or station and network signaling, it is also useful for both PBX and circuit installation testing to verify that transmission and signaling parameters are correct. The set is used on telephone circuits at the demarcation point between a PBX installation and the network. The set can make required level, frequency, signal-to-noise, and noise measurements for circuit installation. Both two-wire and four-wire return-loss measurements are included in the 1180.

The system can simulate either originating or terminating conditions on a circuit and displays signal responses from a distant end. Microprocessor-controlled, the 1180 uses an 8-by-30-character LCD and soft control keys, and it includes menu-driven tests.

Front-panel jacks provide connection to the circuit under test, including transmit, receive, and signaling pairs, and allow connection of a portable telephone set. Available now, the 1180 is priced at $4,795.

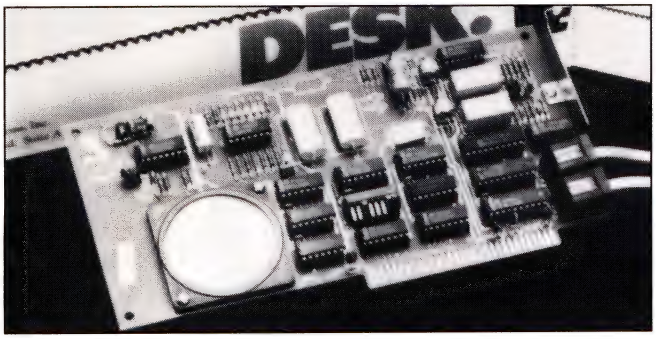
Telecommunications Technology Inc., 555 Del Rey Ave., Sunnyvale, Calif. 94086. Phone (408) 735-8080 [Circle 345]

Board and software give IBM PCs PBX capabilities

Consisting of an interface board and a software program, MyDesk version 3.0 transforms an IBM Personal Computer or compatible computer into a telecomputing work station. It provides the PC with sophisticated PBX capabilities such as conference calling and speed dialing, as well as call transfer, waiting, hold, and forwarding.

The telephone-management features also include dial-by-name, phone messaging, and tracking the time of calls. According to the company, MyDesk supports nearly all PBX systems, analog and digital, including Horizon and Dimension from AT&T, CBX from Rolm, SL 1 from Northern Telecom, the SX series from Mitel, and Focus from Fujitsu. MyDesk can conform to any data-communications access method, including local-area networks and microcomputer-to-mainframe links. The system, which sells for $199, is available now.

Third Floor Systems Inc., 1630 Oakland Rd., #A114, San Jose, Calif. 95131. Phone (408) 293-3360 [Circle 344]



Features like auto callback enhance protocol analyzer

One of the new features in the Comstate I data-communications protocol analyzer automatically calls the user back when the problem is found. The other new features include unattended remote control, auto monitor, data reanalysis, built-in V.35 interface, eight triggers that perform 120 diagnostic events, and four counters.

The Comstate I is a low-cost, lightweight analyzer that provides easy-to-use, state-oriented diagnostic programming. The unattended remote feature provides complete control of the Comstate I using an ASCII terminal or another Comstate I over any asynchronous communication circuit. The automonitor feature provides automatic configuration of the tester and automatic data monitoring simply by pressing the run key.

Since random transients are seldom found on the first visit, the Comstate can be left unattended on site to call the technician when the problem condition occurs. Thus, one technician can troubleshoot a number of sites.

The new features are available 60 days after ordering.

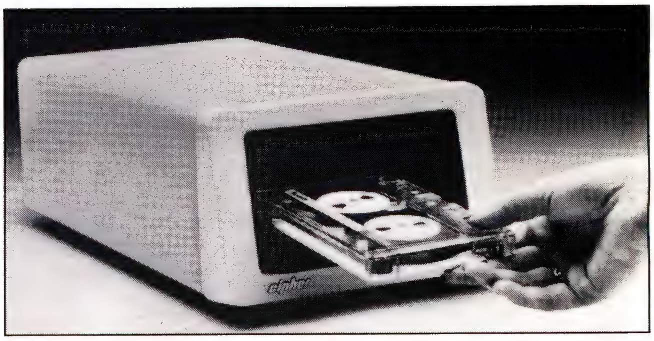
Atlantic Research Corp., 5390 Cherokee Ave., Alexandria, Va. 22312. Phone (703) 642-4000 [Circle 346]

IBM PC AT backup unit copies 20 megabytes on one cartridge

The newest member of the Cipher family of 5210 tape backup systems can be used with the IBM Corp. Personal Computer AT and PC/XT.

The 5210-AT can back up either two 10-megabyte Winchester disk drives or one 20-megabyte Winchester on a single cartridge at a rate of 1 megabyte/min. Larger disks can also be backed up using multiple cartridges.

Also available with the same specifications is a backup



system, called the 5210-C, that is designed for use with IBM PC/XT-compatibles such as the Compaq Plus, Corona PC-HD, and Tandy 1200-HD.

Both systems cost $1,195 and include software and a standard floppy-disk controller card. The interface components can be assembled within the PC AT so that the backup system can be easily connected and disconnected without opening the computer.

Cipher Data Products Inc., OEM Marketing Division, 10101 Old Grove Rd., P.O. Box 85170, San Diego, Calif. 92138.
Phone (619) 578-9100 [Circle 366]

3½-in. Winchester disk drive boasts a 20-megabyte capacity

Using what its manufacturer calls a pseudo-closed-loop positioning system for its read/write heads, the TM362 3½-in. Winchester disk drive can access its formatted capacity of 20 megabytes in 80 ms.

The pseudo-closed-loop positioner is less expensive and complicated than a true closed-loop servo system, and it eliminates the need for either a dedicated servo surface or the embedding of servo information in all of the record gaps on every track.

The TM362 and TM262, a similar model designed to fit a 5¼-in. disk drive form factor, uses a simple and accurate stepper motor to drive a rack-and-pinion actuator—a simpler mechanical system than is used in a standard closed-loop system, the company says.

Each drive has two plated disks that are sputter-coated with a carbon overcoat to provide the hardness and smoothness necessary to preserve data with integrity. In addition, both drives feature the standard industry interface and a 5-Mb/s data-transfer rate. Priced

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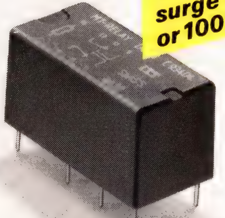

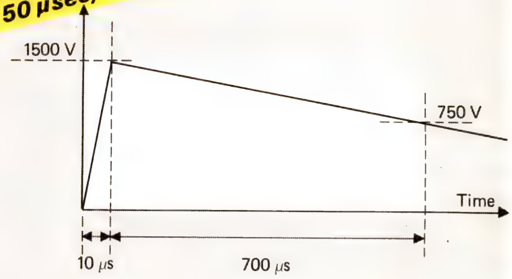

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Tandon Corp., 20320 Prairie St., Chatsworth, Calif. 91311.
Phone (818) 368-8212 [Circle 365]

Portable LED screen provides split-screen option for laptops

Many laptop and portable printers suffer because they are equipped with inadequate screens. The Thinview 25 addresses that problem by offering users of such machines a full 25-line-by-80-column portable LCD display.

The screen, which measures 6.5 by 11.75 by 1.5 in., can also provide 128,000 addressable dots for graphics display or, in the split-screen mode, combine text and graphics in a single display. Weighing 2 lb, the screen operates on its own rechargeable battery that can run continuously for up to seven days without recharging.

Featuring its own multiprocessor architecture that includes several dedicated screen controllers and an executive CPU that uses the Z-80 instruction set, the system supports standard 8-bit operating systems such as CP/M. An ac adapter for desktop use is included in the screen's $749 price. Delivery takes four to five weeks.

Axonix Corp., 417 Wakara Way, Salt Lake City, Utah 84108.
Phone (801) 582-9271 [Circle 364]

IBM PC-based CAD work station costs under $10,000

Complete with all necessary hardware and software, the Cadstation computer-aided design system costs under $10,000.

The system includes an IBM Corp. Personal Computer with high-resolution graphics, 640-K bytes of RAM, a 10-megabyte Winchester disk drive, a floppy-disk drive, an 8087 math coprocessor, two RS-232-C serial ports, a parallel port, MS DOS 2.1, a six A/B-size plotter, and a digitizing tablet. Also included are an enhanced version of Autocad design software, a 16-hour training course, and a 300-page instruction manual.

Autocad features zooming, automatic dimensioning, user-definable menus, object attributes, text generation, layering, object snap, and dynamic shape dragging. The software can be tailored for specific applications or it can be used as a general-purpose drafting tool. The company offers several options for the system, including a color monitor, local-area networking, a streaming tape drive for memory backup, and a selection of plotters including the Cal Comp A/E eight-pen professional plotter.

The CADstation, which is available for immediate delivery, lists for $9,975.

CAD Design Systems Inc., 1305 Remington Rd., Suite D, Schaumburg, Ill. 60195. Phone (312) 882-0114 [Circle 359]

Device speeds trace routing for CAD systems network

Taking jobs in from computer-aided design systems linked by an Ethernet-based local-area network, the CDX-75000 route engine accelerator acts as a shared resource providing high-speed autorouting at a rate of 35 million instructions/s.

The system's algorithm rips up and reroutes traces, moving them to clear a path for new completions. The route engine selects from over 40 different cost functions and combines them appropriately to suit the needs of pc-board routing. This feature also can choose the lowest-cost path from one pin to another.

The router is fully re-entrant, allowing the designer to halt the operation at any time to make changes to the board. The router can be set to stop after a user-specified maximum routing time so that a designer can decide to complete the board manually or let the router continue until it is done. Once finished, the router performs a finishing pass to improve route quality and, the company says, ensure for the board the highest degree of manufacturability.

Available for delivery in June, the route engine costs $77,000.

Cadnetix Corp., 5757 Central Ave., Boulder, Colo. 80301.
Phone (303) 444-8075 [Circle 360]

Network for IBM PCs lets users pick the transmission medium

A short-slot adapter board containing Intel's 82588 data-link controller chip is the heart of LT LAN, a local-area network that is capable of linking IBM Corp. Personal Computers, PC/XTs, PC ATs, and compatibles. The board, which fits in the short slot in the PC's chassis, sells for $225 each.

LT LAN is based on emerging standards and follows the architecture of the International Organization for Standardization reference model. It is fully Ethernet-compatible at the data-link level, and it employs carrier-sense multiple-access protocols with collision detection at the physical-link level.

The customer can choose a transceiver to suit his needs for a transmission media; the transceiver rides piggyback on the adapter board. Transceiver boards will be available for twisted-pair/RS-422, twisted-pair/RS-485, and RG-59 coaxial cable, the same cable used in the IBM PC network. Short-, medium-, and long-distance cable kits are available. PCs connect to each other in a simple daisy-chain fashion with as many as 140 PCs on the network, up to one mile in total distance. Over 1,000 PCs can be supported in an interconnected LAN.

In addition, the modular transceiver also contains the clock generator to determine the bit rate of the net. The initial offering runs at 1 Mb/s, with a 2-Mb/s version to be offered later. Since the transceiver board is easily removed, the user can upgrade the net or change the transmission medium.

LT LAN employs the Advanced NetWare file-server software from Novell Inc. Advanced NetWare allows networked PCs with PC DOS 2.1, 3.0, or 3.1 access to shared files, data bases, and printers on a PC/XT or PC AT acting as a dedicated or nondedicated server. More than one of the PCs can be a file server. By supporting PC DOS 3.1, LT LAN is compatible

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Circle 87 on reader service card

with the IBM PC network at the application level.

In addition, Advanced NetWare supports internetworking, using the popular Xerox Network Systems (XNS) protocols. Electronic mail also comes standard with Advanced NetWare, as does remote dial-in capability.

The PC LT LAN with the RS-422 transceiver module for twisted-pair media will be available in July. Advance NetWare is priced at $1,595.

PC LAN Technologies Inc., 106 Londonderry Office Park, 5780 Lincoln Dr., Minneapolis, Minn. 55436.
Phone (612) 935-7509 [Circle 340]

Existing phone system lets computers chat

Using existing wiring and PBX installations, computer users can dial up other computers in the same or another building by means of the ECB-2W network.

The network will support any protocol and data speeds up to 19,200 b/s. In addition, complete end-to-end security is provided to eliminate the possibility of eavesdropping.

Installation merely requires unplugging the telephone from the wall, plugging it into the ECB-2W, and then plugging the ECB-2W into the wall. A user does not have to be present to receive a call and can use the telephone normally when data is not being sent. For permanent connections, a simple two-wire metallic circuit can be used. This feature also allows existing four-wire metallic circuits to be split into two separate circuits to double the capacity of existing cables.

Prices begin at $700 per node. The equipment is available immediately.

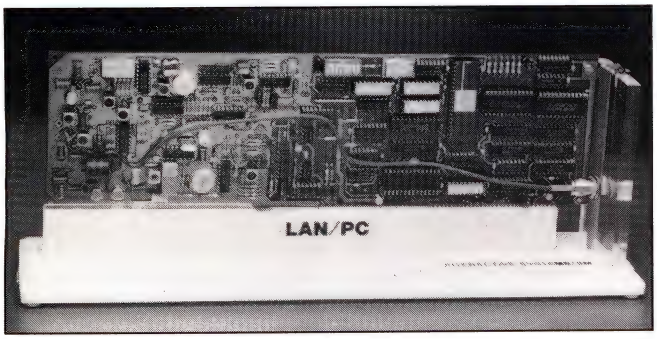
Nokia-Kinex Corp., 6950 Bryan Dairy Rd., Largo, Fla. 33543.
Phone (813) 541-6404 [Circle 341]

PCs and compatibles interface with broadband LAN

A "network of networks" is the manufacturer's description of LAN/PC, a hardware and software package that allows IBM Corp. Personal Computers, PC/XTs, PC ATs, and their compatibles to interface directly with a broadband, coaxial-cable local-area network. Not limited to IBM protocol only, LAN/PC can tie almost any existing baseband system running Novell's NetWare into a coax broadband LAN, and, the manufacturer says, it is supported by over 700 multiuser software packages.

LAN/PC can extend out to a 7-mile radius from the translator (optionally to 40 miles). Each 6-MHz cable-TV channel supports up to 255 directly attached nodes, or thousands of nodes connected through LAN/PC bridges.

At present, around 10 baseband networks, such as Ethernet, Arcnet, 3COM, and others, can be tied into LAN/PC through bridges for uninterrupted and transparent communication. Gateways to X.25 and Systems Network Architecture protocols are available for direct communication without outside resources, and mainframe connection is possible using a 3270 communications server.



The manufacturer will quote price and delivery time based on the configuration the customer wishes to install.

3M Interactive Systems, P.O. Box 33600, St. Paul, Minn. 55133.
Phone (612) 733-9534 [Circle 342]

Multibus II boards target video, data conversion

Two single-board computers use Intel Corp.'s 32-bit Multibus II architecture for controlling color video display and analog-to-digital conversions.

The MIB II 86/78 single-board computer is the first 32-bit Multibus II product for video and graphics applications, the company says. With resolution of 1,024 by 1,024 pixels, the board allows simultaneous use of a number of colors from the computer's palette of 256. The MIB II 86/78 has 512-K bytes of on-board memory and a second 512-K bytes that can be accessed through two of the Multibus II data pathways—the iPSB Parallel System Bus and the iLBX Local Bus Extension.

The video controller depends on three 8-MHz microprocessors to provide rapid data transfer and video-screen refresh. It supports windowing, split screens, and zoom capabilities, and it sports interfaces for a keyboard and a mouse.

The manufacturer's second offering, the MIB II 86/40 ADC computer board, includes a 12-bit, 20-kHz ADC with programmable gain control and either 16 differential or 32 single-ended analog input channels for data acquisition. The board also has 16 digital I/O channels.

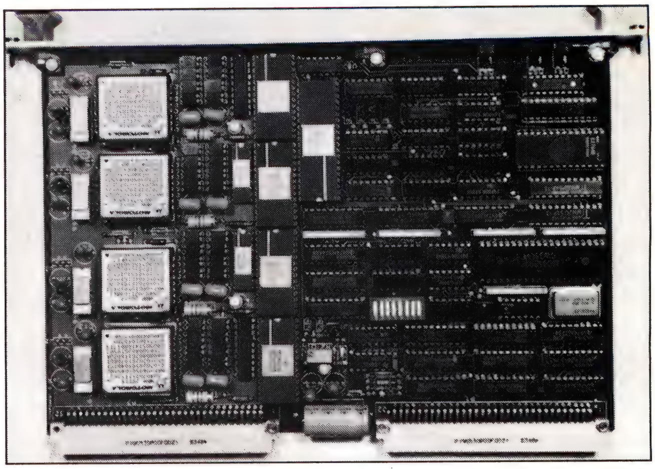
Both boards can operate either as a stand-alone controller, a bus multimaster, or an intelligent slave controller. In quantities below 10, the video and graphics board is tagged at $3,000 and the ADC board at $2,350. Discounts for original-equipment manufacturers are available. Shipments begin in the fourth quarter of this year.

Micro Industries, 691 Greencrest Dr., Westerville, Ohio 43081.
Phone (614) 895-0404 [Circle 354]

Bubble memory for VMEbus provides 512-K bytes

Protecting computer memory from harsh factory environments is a difficult task, but it is made easier with a magnetic bubble-memory board designed for VMEbus control systems.

Bubble memories have no moving parts to be damaged by excessive vibration, heat, or use, and they need no batteries to protect against power failure. Jointly developed by Motorola Inc. and Xycom Inc., the XVME-160 memory board has up to 512-K bytes of nonvolatile storage capacity that can be ac-



cessed, Xycom says, five to ten times faster than floppy-disk drives.

Using Motorola's MBM-2011 bubble-memory chips and an on-board 68B09 CPU for the intelligent interface, the board can perform interrupts on all seven levels, according to Xycom. The CPU can become a host memory controller when up to seven slave memory boards are connected through a mass terminated cable and P2 connector. Since the slaves do not need their own controllers, they can hold more memory, thus providing a system with up to 5 megabytes of capacity.

Other features include the board's communication facility, a 4-K-byte dual-access RAM located in the short I/O address space, self-diagnostic capabilities, and a set of three LEDs that indicate the board's status. The Xycom board comes in two versions: the 256-K-byte XVME-160/Flash 1 costs $2,400, and the 512-K-byte XVME-160/Flash 2 costs $3,500. Available July 1, delivery will take from 30 to 45 days.

Xycom Inc., 750 N. Maple Rd., Saline, Mich. 48176.
Phone (313) 429-4971 [Circle 356]

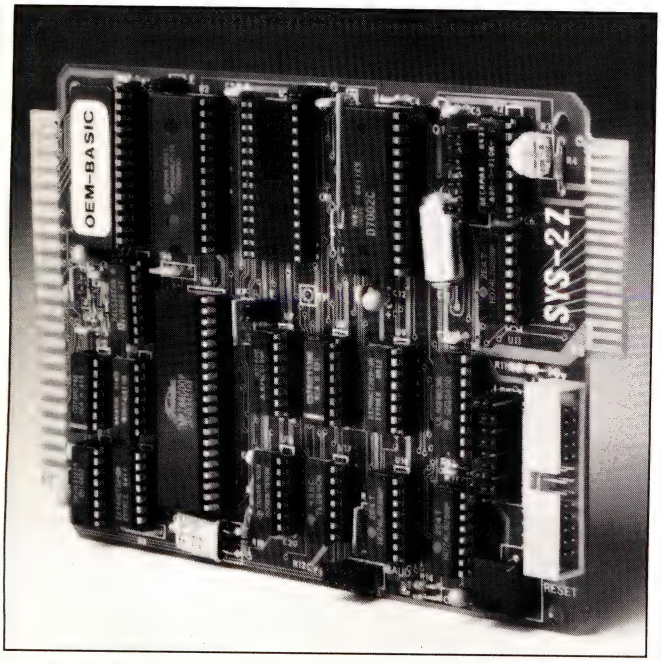
Z80-based computer board has resident Basic software

Built-in floating-point Basic software in the SYS-2Z single-board control computer makes program development fast and simple. The manufacturer claims that the resident OEM-Basic language reduces software and system development time ten- to twentyfold.

The computer board includes a debug monitor for users who wish to combine the Basic program with an assembly code. It has 28 digital and analog I/O lines and 13 digital outputs including both TTL and high-current lines. Eleven digital inputs are TTL-compatible and four analog inputs have 10-bit resolution.

Based on the Z80 microprocessor, the SYS-2Z has 8-K bytes of RAM for program development that can be doubled using an off-board add-on. Up to 16-K bytes of EPROM is available for program or process data storage.

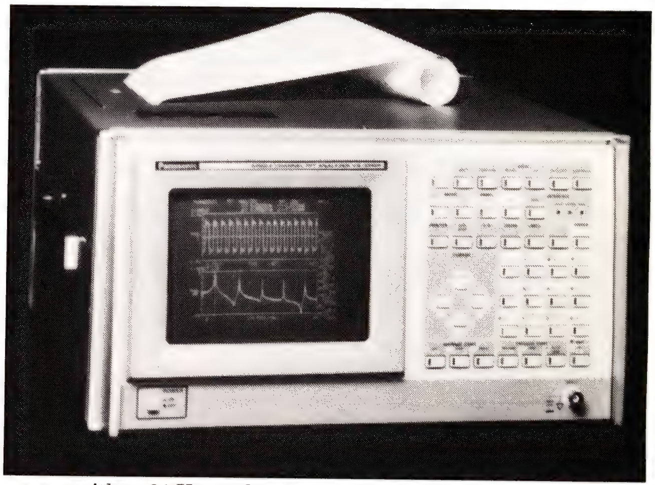
The board conforms to the manufacturer's 44-pin OEM-Bus, which allows users to modularly expand their systems. It includes an RS-232-C serial port for connection to a CRT for program development or a printer, keyboard, or other interface. Available from stock, additional peripheral boards are available, as is software support. The SYS-2Z, priced at $345, comes with OEM-Basic software, a debug monitor, and complete documentation.



Octagon Systems Corp., 6501 W. 91st St., Westminster, Colo. 80030. Phone (303) 426-8540 [Circle 355]

Analyzer superimposes vibration spectra on its display

In addition to a frequency range of dc to 40 kHz, the VS-3310P fast Fourier-transform-based spectrum analyzer offers a three-dimensional display function, particularly useful in audio and acoustic analysis. Part of the memory can be used for superimposing vibration spectra as a 3-d display. The unit comes with a 64-K-word memory, expandable to 128-K words.



The analyzer features low noise floor, high resolution, pre- and post-triggering on transients, and external sampling, which is useful in acoustics, geophysics, and sonics. The built-in intelligence of the unit can be used for go/no-go testing as well as for providing an annotated hard copy at the push of a button when an optional video printer is factory-installed.

Other specifications of the analyzer include a –30-to-30-dB range, 1-MΩ impedance, and 12-bit analog-to-digital conversion resolution. The instrument performs sum, exponential, and peak-hold averaging and does four basic arithmetic operations, comparisons, and differentiation and integration.

The basic analyzer is priced at $6,850; with the video printer option, it goes for $8,100. Delivery takes eight to 12 weeks.

Panasonic, Literature response No. 36P5-38, 1 Panasonic Way, Secaucus, N.J. 07094. Phone (201) 392-4050 [Circle 378]

Standby power system suits noncritical applications

A 1,200-VA standby power source that provides off-line battery/inverter backup power for protection against power failures meets the requirements of Underwriters Laboratories and the Canadian Standards Association. Three models are available—a 120-V 60-Hz design and two 220/240-V 50-Hz units, one with British plugs and outlets and the other with the European type.

The portable unit is economical in less critical applications where the clean, continuous power of an uninterruptible power system is not required. These units are sized to protect smaller electronics, such as point-of-sale terminals, electronic lab monitors and test devices, process controls, communications equipment, and microcomputers.

The system provides protection against power outages by switching from line power to battery/inverter power within one half of a cycle when line voltage drops below –15% of nominal. At that threshold, the load is transferred to the inverter within 4 to 10 ms. When ac voltage returns to within 10% of nominal, retransfer time occurs within 2 to 4 ms.

Its self-contained, maintenance-free, sealed lead-acid battery provides 7 min of reserve time running at full load, 11 min operating at ¾ load, and 18 min at half load. The 120-V system sells for $1,245 and the 220-V models go for $1,340 each. Both are available now.

Sola, 1717 Busse Rd., Elk Grove Village, Ill. 60007.
Phone (312) 439-2800 [Circle 348]

Uninterruptible supply serves desktop computers

An uninterruptible power supply, the model 450AT is designed to power the advanced technology generation of such computers as the IBM Personal Computer/XT and PC AT, Compaq Deskpro, Texas Instruments Business Pro, and the model 7300 Unix computer from AT&T. The 450AT responds within 4 ms typically and 8 ms at a maximum. Nominal service time on the battery/inverter ranges from 5 min with a 300-W load to 45 min with a 60-W load.

The 450AT incorporates an internal sealed, maintenance-free battery and battery charger to ensure dependable power. By providing ac power not only for full outages but also for sags and brownouts, the 450AT addresses the irregularities, which, according to a recent Bell Laboratories study, account for 87% of all power-line-related problems for desktop computers. To address the other 13% of power-line problems, the 450AT incorporates built-in surge protection and interference filtering.

For added protection and convenience, electronic overcurrent protection and a master power switch to control the computer are standard.

American Power Conversion Corp., 89 Cambridge St., Burlington, Mass. 01803. Phone (617) 273-1570 [Circle 347]

Color matrix printer handles variety of paper types, sizes

Switching from data-processing printing on continuous forms to word-processing printing on automatically fed cut sheets takes just 30 s, according to the makers of the 8250 color dot-matrix printer.

Designed for the multiuser, multipurpose business market, the 8250 handles a variety of different sizes and types of paper. Continuous forms, cut sheets, envelopes, and labels can all be stored for almost instant recall in bins within the printer's shell. Users select the stock on which they want to print by using a 16-digit LCD readout in conjunction with a set of touch switches.

The printer features an interactive menu to help users configure the printer and set all parameters. Up to seven sets of parameters can then be stored in the printer's nonvolatile memory for later recall.

The three-speed printer offers a 400-characters/s speed for draft-quality printing, a 100-characters/s text mode, and a near letter-quality mode that prints at 50 characters/s. The 8250 runs software written for the Diablo 630 daisywheel printer—no conversion programming is necessary. Graphics are produced with a resolution of 240 by 240 dots/in. and at a speed of 10 in./s.

The single-unit price for the 8250 is $2,650, but the price falls to $1,900 in quantities of 100 or more. Limited quantities are available now, and full availability will begin in July. Delivery takes 30 days after receipt of order.

Dataproducts Corp., 6200 Orange Ave., Woodland Hills, Calif. 91365. Phone (213) 887-8451 [Circle 372]

Laser printer's Winchester disk provides 2,000 pages of memory

Rattling off 24 pages/min, the Xerox 3700 laser printing system is designed for distributed data-processing systems in which about 40,000 pages are printed a month.

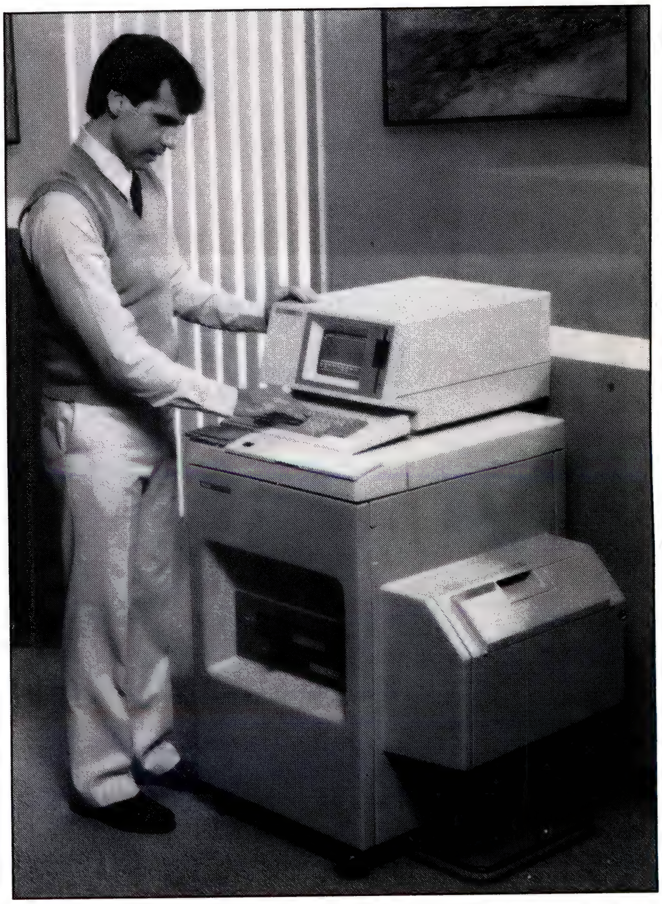
The printer has its own 10-megabyte Winchester disk drive that can store up to 2,000 pages of text and graphics and up to 1,000 fonts and forms, and can receive print jobs from a host computer while simultaneously printing another job. That storage capability saves time and power wasted by expensive retransmissions from the host, the manufacturer says. Up to 16 typefaces and four different electronic forms can be printed on a single page.

The 3700 printing system consists of a controller and the printer. The controller includes a display screen, keyboard, 5¼-in. floppy-disk drive, and the 10-megabyte Winchester disk drive, while the printer is made up of the three input trays (one capable of holding 1,500 sheets, and two auxiliary 250-sheet trays), the 500-sheet output tray, the laser imaging unit, and a xerographic engine.

Paper sizes up to 11 by 17 in. can be handled by the software-based unit, which is compatible with IBM Corp. and other host computers. A choice of parallel or RS-232-C interfaces is also offered, as is a library of more than 200 typestyles. Additionally, the printer can be programmed to reproduce custom fonts, signatures, and company letterheads.

Available now in limited locations, the company says the model 3700 laser printing system will be nationally available by the year's third quarter. The single-unit purchase price is $29,995, or it can be leased for two years at $1,050/month. Quantity discounts are also available.

Xerox Corp., Xerox Sq. 006, Rochester, N.Y. 14644.
Phone (716) 423-5078 [Circle 371]



The Japan Information Center of Science and Technology (JICST) has published vol. 1, no. 1 of *Abstracts of Science and Technology in Japan.* Available only in North America, this first quarterly issue describes 506 research and development projects. The abstracts are taken from current Japanese journal literature in electronics and communications; JICST will provide photocopies and translation services for a set fee when an original text is required. Current topics include solid-state devices, laser applications, and superconductors. The 83-page publication is available at $50 from National Technical Information Service, 5285 Port Royal Rd., Springfield, Va. 22161, or call (703) 487-4600 [Circle reader service number 421]

The basics of digital circuits—both combinational and sequential—are presented in *Digital Circuits: Logic and Design* by Ronald C. Emery. Diagrams with explanations of many commercial logic chips are provided, and an appendix presents eight experiments to be carried out by the reader. The publisher offers this text for in-house training programs on logic circuits as well as to electrical engineering students. Priced at $39.75, the 232-page hardcover book is available from Marcel Dekker Inc., 270 Madison Ave., New York, N.Y. 10016. Phone (212) 696-9000 [Circle 422]

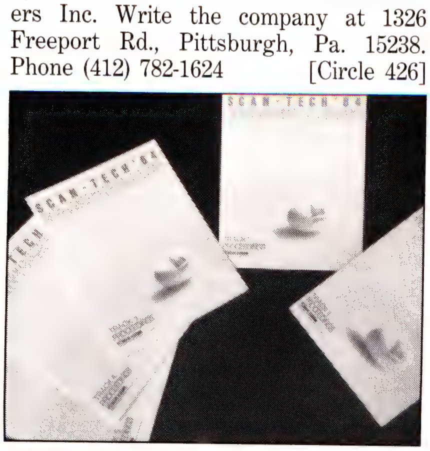
Devoted exclusively to personal computer programming, the *McGraw-Hill Personal Computer Programming Encyclopedia* (William J. Birnes, ed.) covers Ada, Basic (including Interpreted and CBasic), APL, C, DBase II, Lisp, and other high-level languages. The operating systems directory takes in Unix, Xenix, MS-DOS, CP/M, and others, and a separate section describes software by application such as robotics and graphics. Publication date is July 29, and the price is $80. Orders should be sent to McGraw-Hill Book Co., Professional and General Books, 1221 Avenue of the Americas, New York, N.Y. 10020. Phone (212) 512-3493 [Circle 423]

Costs and distribution of all IC packages—dual in-line, chip carrier, quad, small outline, pin-grid array, flat pack, and metal types—will be available in June with the publication of *Chip Carriers and Other Integrated Packages 1984, A Review and Update.* In addition, the report provides profiles on selected systems, semiconductor, assembly, and package houses that are active in the marketplace. Five-year forecasts are included for all IC package types. Offered to subscribers for $3,000, the 1984 report package includes three copies of the latest as well as single copies of the five prior reports published. Orders should be placed with Welterlen Inc., 7460 Girard Ave., Suite 8, La Jolla, Calif. 92037, or phone (619) 454-9119 [Circle 427]

Nearly 500 software listings verified as running on AT&T Co. computers are given in the first issue of the *AT&T Computer Software Guide.* The software falls into one of three categories: software developed specifically for the AT&T computer family, software jointly developed and distributed by AT&T and outside software houses, and software reviewed by AT&T but sold only through independent vendors. The software guide is priced at $19.95. It can be ordered from Reston Publishing Inc. at 11480 Sunset Hills Rd., Reston, Va. 22090, or telephone the company at (800) 336-0338 or, in Virginia, (703) 437-8900 [Circle 424]

Electronic music is the subject of *Digital Audio Signal Processing,* the first book in the publisher's projected Computer Music and Digital Audio Series. Contributions include chapters on digital-filter theory, spiral synthesis, and an introduction to the phase vocoder. The all-digital recording studio is also described. The editor of the volume and the series, John Strawn, is digital audio programmer at Lucasfilm Ltd. and formerly edited *Computer Music Journal.* Copies of this hardcover, 284-page book should be ordered from William Kaufmann Inc., 95 First St., Los Altos, Calif. 94022. Phone (415) 948-5810 [Circle 425]

Scan-tech '84 seminar proceedings are available as printed volumes in five tracks for prices ranging from $20 to $50, or $100 for the complete set. Tape recordings are also available. Called a comprehensive guide to bar coding and other automatic identification technologies, the seminar tracks are distributed by Automatic Identification Manufacturers Inc. Write the company at 1326 Freeport Rd., Pittsburgh, Pa. 15238. Phone (412) 782-1624 [Circle 426]



Microprocessor systems and products are detailed in Intel Corp.'s *1985 Product Handbooks,* containing data sheets, application notes, article reprints, and other design information. The *Product Guide* and the *Yellow Pages Software Directory*—which covers over 2,000 programs—are free; other volumes are priced from $12 to $25. Titles in the handbook series cover quality and reliability, CHMOS, memory components, telecommunications products, microcontrollers, microsystems components (two volumes), development systems, original-equipment-manufacturers' systems, and software. There is a discount on the full set. For more information, or to place an order, write to Intel Literature Distribution, Mail Stop SC6-714, 3065 Bowers Ave., Santa Clara, Calif. 95051. Phone (800) 548-4725 [Circle 428]

The first annual IC Assembly Automation Conference, covering assembly, production, process, and other topics, has published its 200-page *IC Assembly Automation Conference Proceedings.* Twenty complete papers are included, with diagrams and transcripts of the question-and-answer sessions. Attendees may order copies for $40; the price to nonattendees is $75. Orders are being handled by Integrated Technical Marketing, P.O. Box 390207, Mountain View, Calif. 94309. Phone (415) 595-2803 [Circle 429]

An updated directory, the second edition of the *Plexus Software Referral Directory* lists more than 250 software packages—produced and distributed by third-party vendors—that run on Plexus machines. Listed by application, each entry includes vendor contact, information on source language, microprocessor compatibility, available media, and price. Categories include languages and compilers, utilities, text editors, and vertical applications. Order information is available from Plexus Computers Inc., 3833 N. First St., San Jose, Calif. 95134. Phone (408) 943-2236 [Circle 430]

A data base on a formatted disk that is mailed quarterly, *Computer Industry Abstracts* is a menu-driven guide to market information. Lotus graphics are used, and the information can be downloaded into the subscriber's own reports and presentations. Information is abstracted from major computer-industry publications. The disk requires Lotus 1-2-3 and an IBM Corp. Personal Computer, PC AT, PC/XT, or compatible. It is priced at $160. Hard copy is also available at $175. Write to Data Analysis Group, 8263 Vista Dr., La Mesa, Calif. 92041. Phone (619) 464-6888 [Circle 431]

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Issue Date	Editorial Emphasis
June 3	32-Bit Microprocessors
June 10	Special Report: Relays
June 17	Automotive Electronics
June 24	The Next Generation of Engineering Workstations

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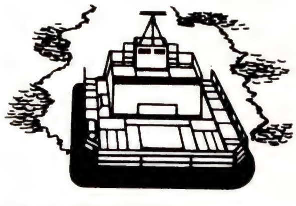
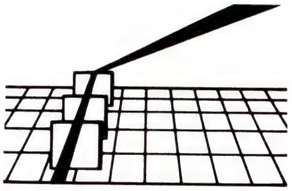
ELECTRONICS

Bell is perfecting a Gravity Sensing System, the only one of its kind in the world, for the U.S. Navy—and participating in advancement of America's military capabilities with Stabilized Antenna Subsystems, all-weather Aircraft Landing Systems and more. Bell's high-precision Accelerometer will make history aboard NASA's Galileo probe, measuring the atmosphere of Jupiter.



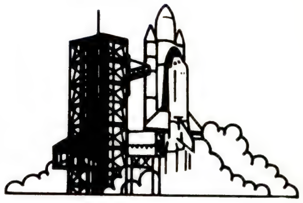
STRUCTURE & VEHICLES

The LACV-30, a high-speed amphibious air-cushion vehicle which Bell is building for the U.S. Army, speeds over the sea at 40 knots and over terrain ranging from ice to swamps to deliver its cargo. Product improvement and designs are a continuing effort as well as technology studies relative to system applications for heavy amphibious vehicles.



LASERS

Bell is making major headway in this important area—with high energy chemical laser systems, beam generators and components. Now under close study by U.S. defense experts, directed energy systems are an exciting technology becoming more and more vital to our national security.



ROCKET PROPULSION

Liquid propellant thrusters developed by Bell will control the Intelstat VI series of communications satellites—expected to handle nearly two-thirds of the world's overseas communications services. Propulsion systems engineered and built by Bell are helping to preserve world peace on strategic missiles for the U.S. and our NATO allies. And propulsion systems and components are being developed now for such exciting future challenges as the Space Station, the Strategic Defense Initiative, and ballistic missile defense.

CURRENT REQUIREMENTS INCLUDE:

- Microwave Antenna Engineering Supervisors
- Electronics Manufacturing Supervisors
- Electronics Inspection & Test Supervisors
- Senior Electronic Systems Engineers
- Electronics Manufacturing Engineers
- Supplier Product Assurance Representatives
- Electronics Quality Engineers
- Mechanical Quality Engineers
- Laser Optics Scientists
- Laser System Test Engineers
- Electronics Program Managers
- Liquid Propulsion Technical Directors
- Principal Rocket Propulsion Engineers
- Liquid Propulsion System Designers
- Advanced Manufacturing Engineers
- Manufacturing Processes Development
- Industrial Engineers
- Project/Proposal Estimators
- Data Base Management Analysts
- Data Processing Project Analysts
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- Electronics Publication Writers

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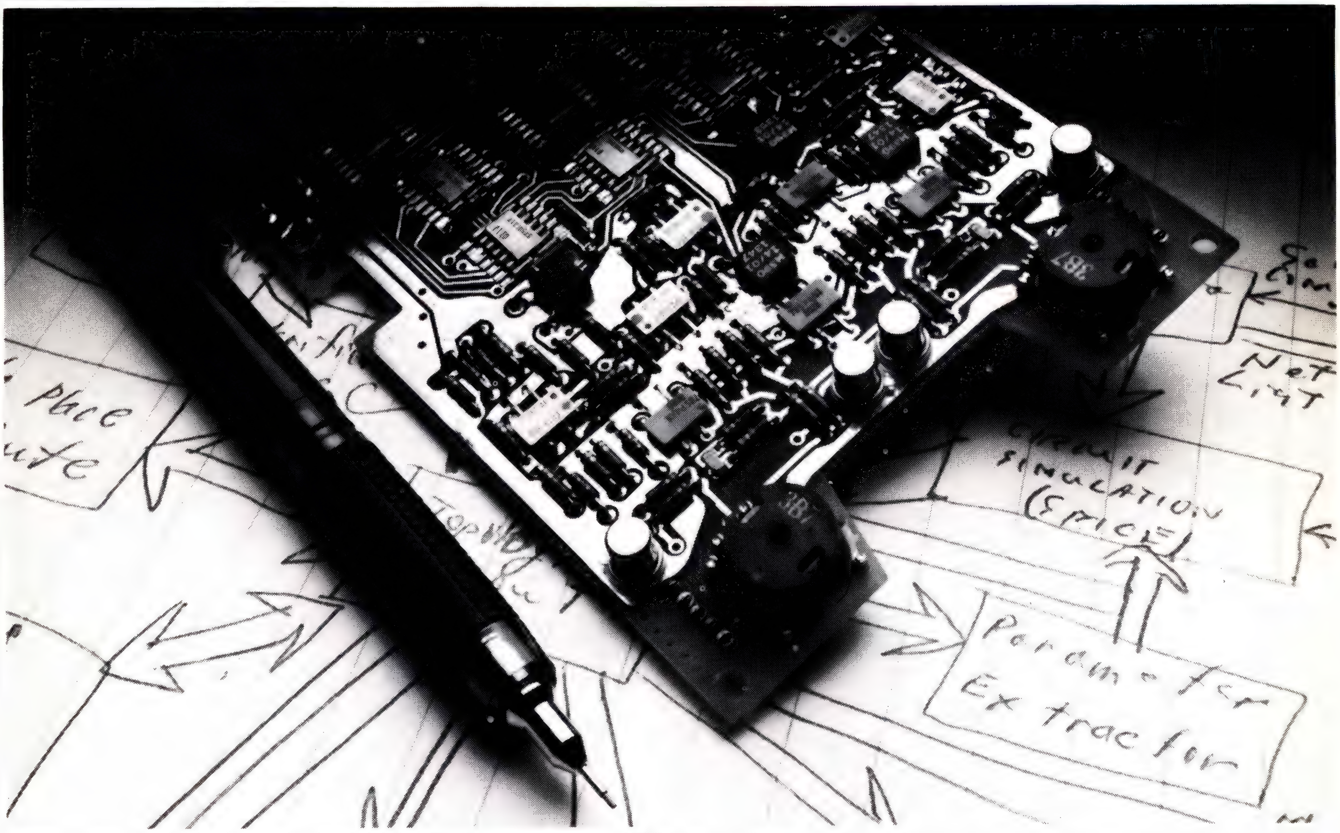

Aerospace engineers often work for big companies on big projects. Accordingly, they make big plans for their future. But if you've ever worked for a large company you know that you can plan on one thing for certain: that your best efforts—much like your aspirations—often go unrecognized.

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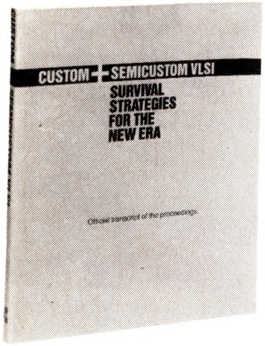
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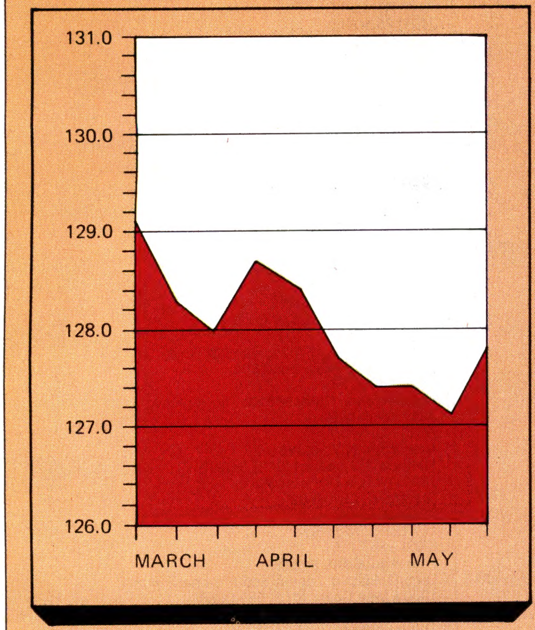
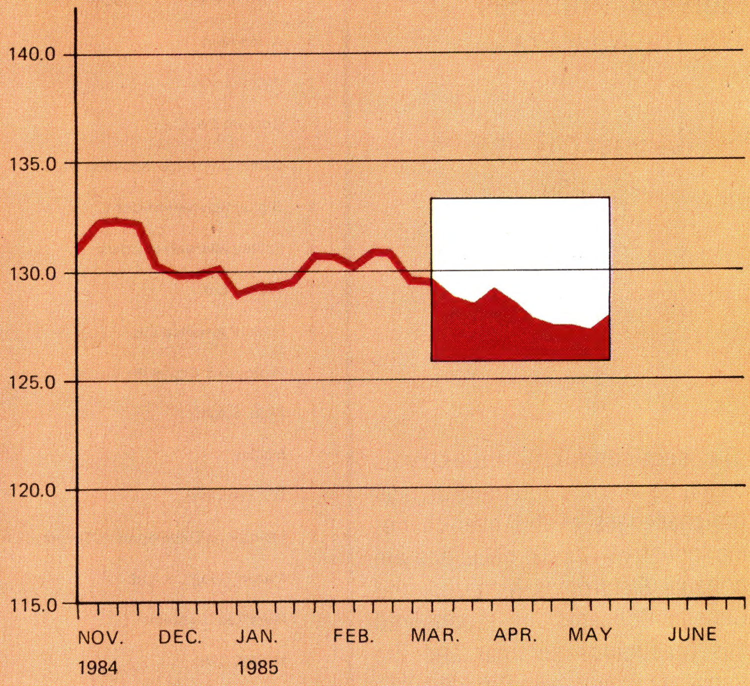
ELECTRONICS WEEK INDEX



THIS WEEK = 127.8
LAST WEEK = 127.1
YEAR AGO = 124.0
1982 = 100.0



The *ElectronicsWeek* Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators. Different indicators will appear from week to week.

U.S. ELECTRONICS PRODUCTION INDEX

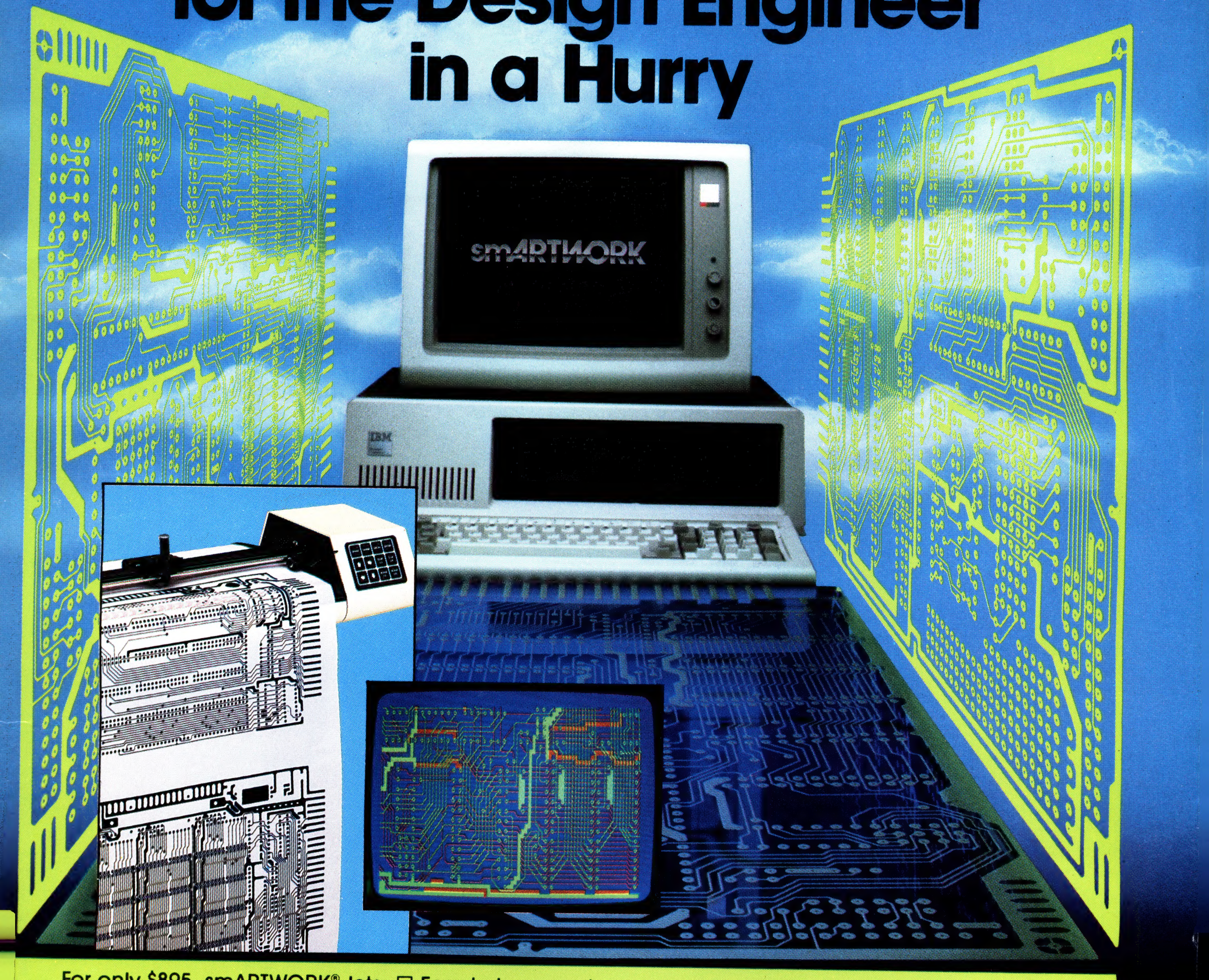
	March 1985	February 1985	March 1984
Office and data-processing equipment	366.2	354.2	312.9
Communications equipment	230.8	226.3	196.9
Radio and TV equipment	118.2	109.5	111.6
Electronic and electrical instruments	180.8	179.0	169.7
Components	441.6	445.4	438.6

U.S. ELECTRONICS COMPONENT-PRODUCER PRICE INDEX (1967=100)

	April 1985	March 1985	April 1984
Digital bipolar integrated circuits	60.0	60.3	63.2
Digital MOS ICs	40.4	40.5	43.4
Linear ICs	60.4	60.4	64.1
Capacitors	190.8	190.8	186.0
Resistors	188.0	188.5	181.4
Relays	312.6	312.6	303.0
Connectors	233.3	233.3	227.0

Increased production in the U.S. of just about all categories of electronic equipment resulted in a 0.6% gain in the *ElectronicsWeek* Index. The biggest gain was registered by radio- and TV-equipment manufacturers, whose production rose 8% in March, according to the latest government statistics. This was followed by a 3.4% gain in output by data-processing and office-equipment makers. Trailing were makers of communications equipment, with a gain of 2%, and instrument manufacturers, with a 1% rise. Components makers reported that production fell almost 1%.

Circuit-Board-Artwork Software for the Design Engineer in a Hurry



For only $895, smARTWORK® lets the design engineer create and revise printed-circuit-board artwork on the IBM Personal Computer. You keep complete control over your circuit-board artwork—from start to finish.

Forget the tedium of taping it yourself or waiting for a technician, draftsman, or the CAD department to get to your project.

smARTWORK® is the only low-cost printed-circuit-board artwork editor with all these advantages:

☐ Complete interactive control over placement and routing
☐ Quick correction and revision
☐ Production-quality 2X artwork from a pen-and-ink plotter
☐ Prototype-quality 2X artwork from a dot-matrix printer
☐ Easy to learn and operate, yet capable of sophisticated layouts
☐ Single-sided and double-sided printed circuit boards up to 10 x 16 inches
☐ Multicolor or black-and-white display

System Requirements:

☐ IBM Personal Computer, XT, or AT with 256K RAM, 2 disk drives, and DOS Version 2.0 or later
☐ IBM Color/Graphics Adapter with RGB color or black-and-white monitor
☐ IBM Graphics Printer or Epson FX/MX/RX series dot-matrix printer
☐ Houston Instrument DMP-41 pen-and-ink plotter
☐ Optional Microsoft Mouse

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Circle 901 on reader service card

There's Room in One LCD Module for the Entire Globe.

–It Displays 2,000 Characters on a Large Screen–

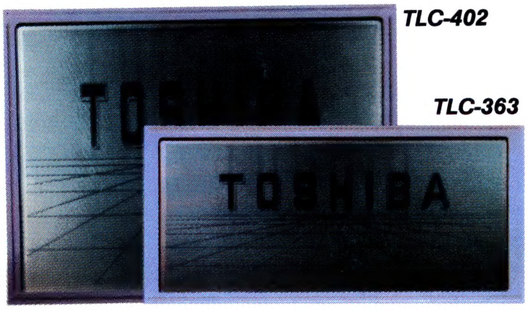
Simulated pi

New LCD modules from TOSHIBA give you 640 × 200 dot displays plus your choice of display area: virtually the size of an ordinary magazine or half that size.

The large display area puts a lot of information on view – either module can give you an array of 80 characters × 25 lines. Yet TOSHIBA technology cuts bulk and power consumption to the bone. These slim LCD modules are battery-powered, and they are compatible with current CRT displays without changing software.

All these features add up to portability. Versatility. Usability. These LCD modules are ideal as displays for portable word processors, personal computers, POS terminals and other display terminals.

Ask us. TOSHIBA is there when it comes to the technology you need in LCD components.



Specifications

		TLC-402	TLC-363
Display			
Number of Characters		80×25 (2,000 characters)	80×25 (2,000 characters)
Dot Format		8×8, alpha-numeric	8×8, alpha-numeric
Overall Dimensions (W×H×D)		274.8×240.6×15.0 mm	275.0×126.0×15.0 mm
Maximum Ratings			
Storage Temperature		–20 – 70°C	–20 – 70°C
Operating Temperature		0 – 50°C	0 – 50°C
Supply Voltage	V_{DD}	7 V	7 V
	$V_{DD}-V_{EE}$	18 V	18 V
Input Voltage		$0 \leq V_{IN} \leq V_{DD}$	$V_{SS} \leq V_{IN} \leq V_{DD}$
Recommended Operating Conditions			
Supply Voltage	V_{DD}	5 ±0.25 V	5 ±0.25 V
	V_{EE}	–13 V Max.	–13 V Max.
Input Voltage	High	4.0 V Min.	4.0 V Min.
	Low	0.5 V Max.	0.5 V Max.
Typical Characteristics (25°C)			
Response Time	Turn ON	300 ms	300 ms
	Turn OFF	300 ms	300 ms
Contrast Ratio		5	5
Viewing Angle		15 – 35 degrees	15 – 35 degrees

Design and specifications are subject to change without notice.

TOSHIBA

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